APPENDIX A

RCRA SAMPLING AND ANALYSIS PLAN

APPENDIX A1: RCRA Pond Quality Assurance Project Plan (QAPP)

APPENDIX A2: Field Sampling Plan For RCRA Groundwater Monitoring

APPENDIX A3: Field Sampling Plan for RCRA Pond Cap Monitoring

APPENDIX A-1

RCRA Quality Assurance Project Plan (QAPP)

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1.0 PROJECT MANAGEMENT

This plan describes the quality assurance and quality control (QA/QC) requirements for sampling and analyses activities performed at the FMC Idaho, LLC (FMC) facility to meet the Resource Conservation and Recovery Act (RCRA) requirements for interim status specified in 40 CFR 265. This facility ceased producing elemental phosphorus from phosphate ore in December 2001 and is no longer in operation. This plan was prepared in accordance with the following the guidance:

- *QA Project Plans in EPA SW-846* (EPA, 1997);
- *Guidance for the Data Quality Objectives (DQO) Process* (EPA, 2000a),
- *Data Quality Objectives for Hazardous Waste Site Investigations EPA QA/G4HW* (EPA, 2000b);
- *EPA Requirements for Quality Assurance Project Plans* (EPA, 2001);
- *Guidance for Monitoring at Hazardous Waste Sites: Framework for Monitoring Plan Development and Implementation* (EPA, January 2004);
- *Statistical Analysis of Groundwater Monitoring Data at RCRA Facilities Unified Guidance* (EPA, March 2009); and,
- Pursuant to applicable 40 CFR 264 Subpart F criteria and objectives.

This *Quality Assurance Project Plan* (QAPP) will be revised when appropriate, per 40 CFR §265.228. The requirements of this QAPP will be implemented using field sampling plans (FSPs as included in Appendices A2 and A3 of the *Post-Closure Plan*) that provide detailed field procedures for sampling and analyses.

This QAPP and the associated FSPs constitute a RCRA sampling and analysis plan (SAP) used for environmental data collection associated with the RCRA ponds at the FMC Plant Site. Environmental data collection includes:

- Vegetation cover monitoring on the RCRA pond cap surface;
- Settlement monitoring of the RCRA pond cap;
- Topsoil depth monitoring on the RCRA pond "double caps" at Ponds 8S, the Phase IV ponds, Pond 15S, Pond 16S and Pond 18 Cell A;
- Rodent/insect impact monitoring on the RCRA pond cap;
- Evapotranspiration (ET) cap drainage monitoring at the RCRA pond "double caps" at Ponds 8S, the Phase IV ponds, Pond 15S, Pond 16S and Pond 18 Cell A;
- RCRA pond leachate collection, detection and removal system (LCDRS) monitoring (excluding Pond 8S and the Phase IV ponds);
- Groundwater monitoring of the upgradient and downgradient uppermost aquifer;
- Stormwater/snowmelt management monitoring on and around the RCRA pond cap; and
- Survey benchmark monitoring.

This document is organized as follows:

- Section 1 - Project Management addresses project management, including the project history, roles and responsibilities of the participants, overall project monitoring objectives and associated data quality objectives.
- Section 2 - Data Generation and Acquisition addresses all aspects of project design and implementation, which ensures that appropriate methods for sampling, measurement and analysis, data collection or generation, data handling and quality control (QC) activities are employed and properly documented.
- Section 3 - Assessments and Oversight addresses the requirements for assessing the effectiveness of the QC measures described in this QAPP.
- Section 4 - Data Validation and Usability provides requirements for data validation and assurance of data usability.

1.1 PROJECT ORGANIZATION

The project organization is shown in Figure 1.

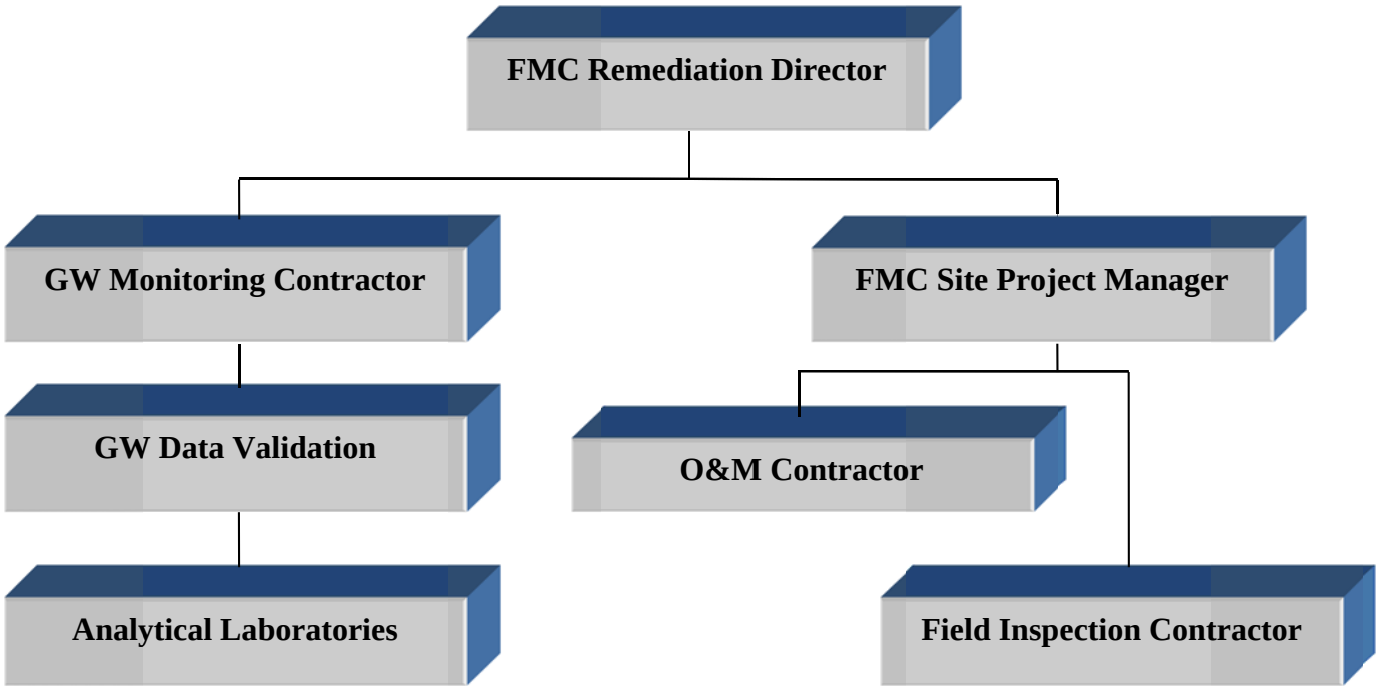

Figure 1. RCRA Pond Post-Closure Project Organization

The responsibilities of key project positions are as follows:

- FMC Remediation Project Director - overall project responsibility.
- FMC Site Project Manager - responsible for managing specific field activities (e.g. groundwater monitoring/cap monitoring) including direct management of field supervisors and contractors. Also responsible for assembly, organization and maintenance of all information collected during monitoring activities.
- FMC Groundwater Monitoring, Field Inspection and O&M Contractors - responsible for the representativeness of groundwater samples collected and reporting of field data relevant to monitoring and data management. The groundwater monitoring contractor is also responsible for maintenance of the groundwater monitoring database. The field inspection contractor is responsible for performing visual inspections, monitoring system data collection and reporting to FMC and specific maintenance items. The O&M contractor is responsible for maintenance as indicated based on field inspections and as directed by FMC.
- FMC Analytical Laboratory Contractor QA Officer - responsible for the accuracy and precision of data resulting from analysis of monitoring samples.
- FMC Data Validation Contractor - responsible for validation of data.

All personnel are responsible for identifying problems that may arise in the collection and reporting of project data and overseeing the implementation of the necessary corrective actions. The FMC Site Project Manager will track, review, and verify the effectiveness of corrective actions.

1.2 BACKGROUND

The FMC Pocatello Plant site is located in southeastern Idaho, approximately 2.5 miles northwest of Pocatello, Idaho. The FMC Pocatello Plant was a RCRA treatment, storage, and disposal facility (EPA Identification Number IDD 070929518). The FMC Pocatello Plant was in continuous operation from 1949 through 2001. The facility ceased producing elemental phosphorus from phosphate ore in December 2001. Process decommissioning and plant site dismantling activities were completed in 2006. RCRA groundwater monitoring has been conducted at the facility since 1990, when the plant became subject to RCRA Subtitle C regulatory requirements (as result of the narrowing of the Bevill exemption) and associated groundwater monitoring standards.

The FMC Plant Site is also a part of the Eastern Michaud Flats (EMF) Superfund Site. The EMF Site was listed on the National Priorities List (NPL) on August 30, 1990. The FMC Plant Site is part of the FMC Plant Operable Unit (OU), an OU within the EMF Site. The EMF site also includes an adjacent production facility (an operating phosphate fertilizer processing plant) owned and operated by the J.R. Simplot Company. The FMC Plant OU consists of all the property that FMC owns within the EMF Site, including the FMC Plant Site and all property that

FMC owns north of that Highway 30 (with exception of the Tesco property). FMC, Simplot and EPA entered into a CERCLA Administrative Order on Consent (AOC) in May 1991 under which the companies agreed to conduct a Remedial Investigation/Feasibility Study (RI/FS) for the site.

FMC ceased production of elemental phosphorus from phosphate ore at its Pocatello facility in December 2001. This led EPA and FMC to enter into an AOC in October 2003 (SRI/SFS AOC) for a Supplemental Remedial Investigation and Feasibility Study (SRI/SFS) at the FMC Plant Operable Unit (OU). This was driven primarily by EPA's finding that additional investigations and evaluations were needed at the plant areas that had been actively operated at the time of the RI/FS but where operations had terminated with the plant shutdown. After the SRI/SFS is completed, it is anticipated that EPA will issue an Amended ROD specifying the FMC Plant OU remedial action requirements. The RCRA Ponds, being subject to RCRA, are not part of the RI/FS or the SRI/SFS.

As confirmed by the 2003 SOW, the SRI/SFS, like the original RI/FS, will take into account the anticipated future uses of the site and will apply EPA's One Cleanup Program policy so that the CERCLA process also meets parallel RCRA corrective action requirements. The SRI/SFS AOC and SOW acknowledge that the FMC Plant Site includes 1) hazardous waste management units that have been closed in accordance with RCRA and RCRA consent decree requirements, and 2) former Calciner Ponds where FMC has conducted remedial action pursuant to a consent order with IDEQ.

The scope of this QAPP covers the RCRA post-closure activities associated with the closed RCRA Ponds. These closed ponds include:

- Pond 8E
- Pond 9E
- Pond 8S
- Phase IV Ponds (consisting of Ponds 11S, 12S, 13S and 14S)
- Pond 15S
- Pond 16S
- Pond 17
- Pond 18 Cell A

1.3 PROJECT DESCRIPTION

This section identifies and provides a schedule and specifies the nature of monitoring at each of the FMC RCRA ponds subject to RCRA post-closure monitoring. Each pond and associated RCRA monitoring locations are identified in figures and Appendices in the FSPs.

1.3.1 PROJECT SCHEDULE

Post-closure monitoring will continue for 30 years after completion of closure of each RCRA pond unless shortened or lengthened by the Regional Administrator in accordance with 40 C.F.R. §265.117. FMC will petition EPA to reduce the post-closure monitoring period in accordance with 40 C.F.R. §265.118(g) in the event the Company concludes that a monitoring period of shorter duration is warranted. RCRA interim status groundwater monitoring pursuant to 40 CFR. Part 265, Subpart F, has been ongoing at the facility on a quarterly basis since 1991. The results of the groundwater assessment program will be reported in the *RCRA Interim Status Annual Groundwater Assessment Report*. RCRA cap integrity monitoring is monitored at specified frequencies and will be reported in the *RCRA Pond Annual Post-Closure Report*.

1.4 DATA QUALITY OBJECTIVES

Data quality refers to the level of reliability associated with a particular data set or data point. The data quality associated with Performance Objective compliance monitoring data is a function of the sampling plan rationale, the sample collection procedures, and the analytical methods and instrumentation used in making the measurements. The overall QA objective is to develop and implement procedures for field sampling, COC, laboratory analysis, and data reporting that will provide data that meet project DQOs and are legally defensible. Data quality objectives are qualitative and quantitative statements that specify the field and laboratory data quality necessary to support specific decisions or regulatory actions. The DQOs describe which data are needed, why the data are needed, and how the data are to be used to meet the needs of the Performance Objective compliance monitoring. DQOs also establish numeric limits for the data to allow the data user (or reviewers) to determine whether the data collected are of sufficient quality for their intended use.

The DQOs for the RCRA Ponds post-closure monitoring are discussed below. The DQOs for all the monitoring activities have been developed in accordance with the Guidance for the Data Quality Objectives Process, EPA QA/G-4 (U.S. EPA, 2000a) and additional guidance as provided in Data Quality Objectives for Hazardous Waste Site Investigations, EPA QA/G- 4HW (U. S. EPA, 2000b). The remainder of this section defines how the data will be assessed to meet the DQOs and the criteria that will be used to define acceptable limits of uncertainty.

1. State the problem. *Concisely describe the problem to be studied. Review prior studies and existing information to gain a sufficient understanding to define the problem. Identify the planning team members, including the decision-makers. For each data gap category, the problem statement is presented. Planning team members and decision-makers are the same for each data collection activity.*

2. Identify the decision. *Identify what questions the study will attempt to resolve and what actions may result from each decision. Develop a decision statement.*

3. Identify the decision inputs. *Identify the information that needs to be obtained and the measurements that need to be taken to resolve the decision statement.*

4. Define the study boundaries. *Specify the time periods and spatial boundaries to which decisions will apply. Determine when and where data should be collected. Define the target population of interest.*

5. Develop the decision rules. *Define the statistical parameter of interest, specify the action level, and integrate the previous DQO outputs into a single statement that describes the logical basis for choosing among alternative actions. Define an "if... then..." statement.*

6. Specify tolerance limits on decision errors. *Define the decision-makers' tolerable decision error rates based on a consideration of the consequences of making an incorrect decision.*

7. Optimize the sampling design. *Evaluate information from the previous steps and generate alternative data collection designs. Choose the most resource-effective design that meets all DQOs.*

1.4.1 OVERALL POST-CLOSURE MONITORING OBJECTIVES

The Data Quality Objectives (DQOs) have been developed for the RCRA pond post-closure monitoring as presented in the original *FMC RCRA Quality Assurance Plan* (*Attachment 10-1 of the RCRA Pond Post-Closure Plans*). These DQOs for the RCRA pond post-closure monitoring have been updated and expanded to address all post-closure monitoring activities. The following presents a discussion on the overall post-closure monitoring objectives upon which the amended DQOs are based.

1.4.1.1 Maintaining the Integrity and Effectiveness of the Final Cover

The post-closure performance standards for maintaining the integrity and effectiveness of the final cover are set forth in 40 CFR §265.228(b)(1) and §265.310(b)(1). These state that during the post-closure care period, the owner or operator must "*Maintain the integrity and effectiveness of the final cover, including making repairs to the cover as necessary to correct effects of settling, subsidence, erosion, or other events.*" The following describes the post-closure actions that FMC will take to ensure that this performance standard is being met.

- Collecting sufficient data and information to determine if the pond cover system is being maintained such that the cap is capable of performing as designed, i.e., limiting infiltration of precipitation into the wastes within the pond and taking corrective action when deficiencies are noted. The specific actions to meet these objectives consist of the following:
    - Surface vegetation monitoring;
    - Settlement monitoring;
    - Topsoil depth monitoring;
    - Rodent/insect infestation monitoring;
    - ET cap drainage monitoring; and
    - Maintenance or repair as needed to comply with the performance standard based on the monitoring.

The DQOs associated with the maintaining the integrity and effectiveness of the final cover on the RCRA ponds are presented in Table 1.1.

1.4.1.2 Maintaining and Monitoring the Leak Detection System

The post-closure performance standards for maintaining and monitoring the leak detection system are provided in 40 CFR §265.228(b)(2) and §265.310(b)(2) which state that during the post-closure care period, the owner or operator must "*Maintain and monitor the leak detection system … and comply with all other applicable leak detection system requirements*." The following describes the post-closure actions that FMC will take to ensure that this performance standard is being met.

- Ensuring that the LCDRS is properly maintained, including being pumped to minimize the head on the bottom liner, by collecting sufficient data and information to determine and record the amount of liquids being pumped from the system, and taking corrective action when deficiencies are noted. The specific actions to meet these objectives consist of the following:
    - Inspections of the LCDRS system;
    - Pumping of the LCDRS when liquid levels reach the invert of the inlet pipe to the LCDRS sump;
    - Measuring and recording the amount of liquid pumped from the LCDRS: and
    - Maintenance or repair as needed to comply with the performance standard based on the inspections

The DQOs associated with maintaining and monitoring the leak detection system on the RCRA ponds are presented in Table 1.2.

1.4.1.3 Maintaining and Monitoring the Groundwater Monitoring System

The post-closure performance standards for maintaining and monitoring the groundwater monitoring system are provided in 40 CFR §265.228(b)(3) and §265.310(b)(3) which state that during the post-closure care period, the owner or operator must "*Maintain and monitor the groundwater monitoring system and comply with all other applicable requirements*." The following describes the post-closure actions that FMC will take to ensure that this performance standard is being met.

- Ensure the groundwater monitoring system is properly maintained and monitored to collect sufficient data and information to determine if there are releases from each of the closed RCRA ponds that are (or may be) impacting groundwater quality, and to take corrective action when deficiencies are noted. The specific actions to meet these objectives consist of the following:
    - Inspections of the groundwater monitoring wells;
    - Sampling and analysis of upgradient and downgradient wells;
    - Performance of statistical tests on indicator constituents; and
    - Maintenance or repair as needed to comply with the performance standard based on the inspections.

The DQOs associated with maintaining and monitoring the groundwater monitoring system on the RCRA ponds are presented in Table 1.2.

1.4.1.4 Prevention of Run-On and/or Run-Off Erosion or Other Damage to the Final Cover

The post-closure performance standards for prevention of final cover damage from run-on and/or run-off are provided in 40 CFR §265.228(b)(4) and §265.310(b)(4) which state that during the post-closure care period, the owner or operator must "*Prevent run-on and run-off from eroding or otherwise damaging the final cover.*" The following describes the post-closure actions that FMC will take to ensure that this performance standard is being met.

- Inspecting and maintaining the cap surface and stormwater/snowmelt diversion structures (drainage ditches) to minimize cap surface erosion or other damage, and taking corrective action when deficiencies are noted. The specific actions to meet these objectives consist of the following:
    - Inspections of the cap surface for signs of erosion or ponding of stormwater/snowmelt;
    - Inspections of stormwater/snowmelt diversionary structures for accumulation of debris or sediment; and
    - Maintenance or repair as needed to comply with the performance standard based on the inspections.

The DQOs associated with prevention of run-off and/or run-off of stormwater or snowmelt at the RCRA ponds are presented in Table 1.3.

1.4.1.5 Protection and Maintenance of Benchmarks

The post-closure performance standards for protection and maintenance of benchmarks are provided in 40 CFR §265.310(b)(5) which state that during the post-closure care period, the owner or operator must "*Protect and maintain surveyed benchmarks used in complying with §265.309.*" The following describes the post-closure actions that FMC will take to ensure that this performance standard is being met.

- Inspecting and maintaining the benchmarks used to survey RCRA pond location and dimensions and settlement monument movement, and taking corrective action when deficiencies are noted. This specific actions to meet these objectives consist of the following:
    - Inspections of the survey benchmark control stations "94-1" and "94-4"; and
    - Maintenance or repair as needed to comply with the performance standard based on the inspections.

The DQOs associated with protection and maintenance of benchmarks used for surveying at the RCRA ponds are presented in Table 1.3.

1.4.1.6 Maintaining the Security Systems

40 CFR §265.14(a) requires the owner or operator must prevent the unknowing entry, and minimize the possibility of the unauthorized entry, of persons or livestock onto the active portion of the facility. The RCRA ponds area is wholly enclosed within the boundaries of the FMC plant site which has a combination of fencing around the property boundary, natural barriers and controlled entry. Access to the closed unit is and will be controlled to protect the cover, benchmarks, and monitoring systems from inadvertent access of unauthorized persons. The following describes the post-closure actions that FMC will take to ensure that this performance standard is being met.

- Inspecting and maintaining all RCRA pond security systems, including fencing, gates, and signs. Also, to take corrective action when deficiencies are noted. This overall monitoring objective is to be demonstrated through the following monitoring activities:
    - Inspections of the RCRA pond fencing, gates, and signs.
    - Maintenance or repair as needed to comply with the performance standard.

1.5 DESCRIPTION OF POST-CLOSURE MONITORING ACTIVITIES

The following subsections provide a description of the post-closure monitoring activities for the closed RCRA ponds. Each pond and associated RCRA monitoring locations are identified in figures and Appendices in the FSPs as included in Appendix A-2 for groundwater monitoring and Appendix A-3 for RCRA pond cap monitoring.

1.5.1 CAP INTEGRITY MONITORING

40 CFR §265.228(b)(1) and §265.310(b)(1) require that the integrity and effectiveness of the final cover be maintained, including making repairs to the cover as necessary to correct effects of settling, subsidence, erosion, or other events. Several post-closure monitoring activities are conducted to meet these requirements as discussed below:

Surface Vegetation Monitoring – Vegetation of the surface of the RCRA pond caps serves two purposes. First, the vegetation stabilizes the topsoil which helps prevent wind or water erosion. Second, in the case of RCRA ponds that are equipped with a "RCRA double cap", the cap incorporates an ET cap (as installed on RCRA Ponds 8S, Phase IV, 15S, 16S, and 18 Cell A). Vegetation on the surface of an ET cap assists in the evapotranspiration of precipitation that accumulates in the ET cap storage layer. The objective of the RCRA cap vegetation monitoring is to inspect the vegetation cover on the cap surface to ensure that significant areas do not become void of vegetation. To meet the vegetation monitoring objective, the RCRA pond caps are visually inspected and plant counts are made within ten (10) sampling plots per each of three (3) transects annually in the fall to determine if vegetation coverage meets or exceeds the minimum target density of 0.5 plants per square foot at 67% or greater of the sampling plots. This is a quantitative assessment. The procedures for the vegetation monitoring field activities are presented in Section 4.3.1 of the *FSP for RCRA Cap Integrity Monitoring* (included in Appendix A-3 of the

Post-Closure Plan). The cap vegetation inspections will be summarized in the *RCRA Pond Annual Post-Closure Report*. Any areas of the RCRA pond caps that require re-vegetation will be noted on the Inspection Record Form.

Settlement Monitoring – As the RCRA pond caps are constructed of earthen materials, consolidation and settlement of the cap materials of construction are expected. However, excessive settlement is an indication that the cap was not constructed as designed and the integrity of subsurface layers, i.e., the GCL/HDPE layers may be jeopardized. The objective of the cap settlement monitoring is to determine if excessive settlement or movement of pond cap materials of construction is taking place. To meet the settlement monitoring objective, displacement measurements will be made (1) annually until the defined vertical and horizontal displacement limits are reached and then at least once every five years during the post-closure period; (2) if visible subsidence is noted during semiannual run-on and/or run-off erosion monitoring or other monitoring and/or maintenance; and (3) after local seismic events. The displacement limits and criteria for visible subsidence and local seismic events are specified in Section 2.2.1.2 of the *Post-Closure Plan*. No routine sampling and analysis is performed as part of this monitoring. The procedures for the settlement monitoring field activities are presented in Section 4.3.2 of the *FSP for RCRA Cap Integrity Monitoring* (included in Appendix A-3 of the *Post-Closure Plan*). The settlement monitoring results will be summarized in the *RCRA Pond Annual Post-Closure Report*. Any damage to settlement monuments requiring maintenance will be noted on the Inspection Record Form.

Topsoil Depth Monitoring - RCRA ponds that are equipped with a "RCRA double cap" incorporate an ET cap (as installed on RCRA Ponds 8S, Phase IV, 15S, 16S and 18 Cell A). Topsoil depth on the ET cap is a key parameter for accumulation and storage of precipitation in this ET cap "storage layer". The objective of the cap topsoil depth monitoring is to determine if wind and/or water erosion has removed or re-distributed topsoil to the extent that the ET cap design capabilities are diminished. To meet the topsoil depth monitoring objective, topsoil depth on the RCRA Ponds with the RCRA "double cap" will be measured (1) annually and (2) within 48 hours of a high wind event. A high wind event is defined as a calendar day during which the sustained (1-minute averaging time) maximum wind speed exceeds 70 miles per hours as recorded at the Pocatello airport weather station. Measurements of topsoil depth are made against several topsoil depth indicators. No routine sampling and analysis is performed as part of this monitoring. The procedures for the topsoil depth monitoring field activities are presented in Section 4.3.3 of the *FSP for RCRA Cap Integrity Monitoring* (included in Appendix A-3 of the *Post-Closure Plan*). The topsoil depth monitoring results will be summarized in the *RCRA Pond Annual Post-Closure Report*. Any damage to topsoil depth indicators requiring maintenance will be noted on the Record Inspection Form.

Rodent/Insect Infestation Monitoring – For reasons stated above, any damage to the topsoil layer of the RCRA pond cap or damage to the vegetative cover, may impact the cap integrity. The objective of the RCRA cap rodent/insect infestation monitoring is to inspect the RCRA cap surface to identify evidence of rodent burrowing or loss of vegetation from rodent or insect feeding. To meet the rodent/insect infestation monitoring objective, the RCRA pond caps are visually inspected semi-annually to determine if evidence of rodent burrowing or loss of vegetation has occurred. This is a qualitative, rather than quantitative assessment and no routine sampling and analysis is performed as part of this monitoring. The procedures for the rodent/insect monitoring

field activities are presented in Section 4.3.4 of the *FSP for RCRA Cap Integrity Monitoring* (included in Appendix A-3 of the *Post-Closure Plan*). The rodent/insect inspections will be reported in the *RCRA Pond Annual Post-Closure Report*. Any areas of the RCRA pond caps that require maintenance (i.e., repair burrowing activities, seeding, or pest control) will be noted on the Inspection Record Form.

ET Cap Drainage Monitoring - RCRA ponds that are equipped with a "RCRA double cap" incorporate an ET cap (as installed on RCRA Ponds 8S, Phase IV, 15S, 16S and 18 Cell A). A properly functioning ET cap should store precipitation water in the storage layer, to later dissipate the stored water through evapotranspiration. The ET cap is equipped with a drainage layer underneath the storage layer. Precipitation that percolates through the storage layer to the drainage layer will pass through a piping system to be accumulated in the ET cap drainage accumulation sump. Accumulation of ET cap drainage water in excess of design rates may indicate the ET cap is not functioning properly. The objective of the ET drainage monitoring is to determine and record the annual volume of water accumulated from the ET cap drainage layer. Each of these ponds is equipped with one or more ET cap drainage collection sumps. To meet the ET cap drainage monitoring objective, these collection sumps are inspected annually and ET cap drainage accumulation volumes are determined and compared to predicted normal drainage rates. No routine sampling and analysis is performed as part of this monitoring. The procedures for the ET cap drainage monitoring field activities are presented in Section 4.3.5 of the *FSP for RCRA Cap Integrity Monitoring* (included in Appendix A-3 of the *Post-Closure Plan*). The ET cap drainage accumulation volumes will be summarized in the *RCRA Pond Annual Post-Closure Report*. Any deficiencies of the ET cap drainage accumulation system requiring maintenance will be noted on the Inspection Record Form.

1.5.2 LCDRS MONITORING

40 CFR §265.228(b)(2) and §265.310(b)(2) require that the leak detection system be maintained and monitored, and other leak detection system requirements be met according to specific criteria. Six of the RCRA ponds (Ponds 8E, 9E, 15S, 16S, 17 and 18 Cell A) were designed and installed with double liners and an associated leachate collection, detection and removal system (LCDRS). The objective of the LCDRS monitoring is to determine and record the volume and rate of leachate collected at each RCRA pond. Each of these ponds is equipped with one or more leachate collection sumps. To meet the LCDRS monitoring objective, these LCDRS sumps are inspected on a progressive step-wise schedule per 40 CFR § 265.226(b)(2) and leachate accumulation volumes pumped, measured, and recorded as necessary. Other than waste determination of the accumulated leachate, no routine sampling and analysis is performed as part of this monitoring. The procedures for the LCDRS monitoring field activities are presented in Section 4.4 of the *FSP for RCRA Cap Integrity Monitoring* (included in Appendix A-3 of the *Post-Closure Plan*). The leachate accumulation volumes will be summarized in the *RCRA Pond Annual Post-Closure Report*. Any deficiencies of the LCDRS requiring maintenance will be noted on the Inspection Record Form.

1.5.3 GROUNDWATER ASSESSMENT MONITORING

40 CFR §265.228(b)(3) and §265.310(b)(3) require that the groundwater monitoring system be maintained and monitored to comply with 40 CFR Subpart F, as applicable. The objective of the groundwater assessment monitoring is to collect groundwater data to monitor the potential impact

of the RCRA ponds on the underlying, uppermost aquifer. The RCRA ponds and associated groundwater monitoring well network is shown in Table 2.0. To meet the groundwater assessment monitoring objective, quarterly samples from groundwater wells associated with each pond are collected, submitted to an analytical laboratory, and analyzed for the parameters specified in Table 3.1. Field parameters for the quarterly groundwater wells are specified in Table 3.2. These parameters are based on facility operations, previous site investigations, historical RCRA groundwater assessment monitoring program results, and the requirements for groundwater monitoring specified in 40 CFR 265, Subpart F. In June 1995, the RCRA groundwater assessment monitoring program was reduced from a list of 37 inorganic parameters and four radiological parameters to 10 inorganic parameters (EPA, 1995). However, analysis for cadmium has been eliminated from all RCRA groundwater monitoring wells and ammonia will be sampled and analyzed every five years during the second quarter monitoring event at all RCRA groundwater monitoring wells, beginning with the second quarter 2012 [2Q12] monitoring event.. Table 3.1 reflects these changes. Results from analysis of samples collected from specified downgradient detection monitoring wells at each pond will be compared to results from analysis of samples collected from the specified upgradient well(s) to determine if there is statistically significant evidence of a release. The sampling and analysis procedures for the groundwater assessment monitoring field activities are presented in the *FSP for RCRA Groundwater Monitoring* (included in Appendix A-2 of the *Post-Closure Plan*). The quarterly RCRA groundwater assessment results will be reported in the *RCRA Interim Status Annual Groundwater Assessment Report.* Also, as described in Section 2.2.3 of the *Post-Closure Plan*, the physical condition of each groundwater monitoring well (e.g., locking cover, barriers) will be inspected semiannually and deficiencies requiring maintenance will be noted on the Inspection Record Form.

1.5.4 RUN-ON AND RUN-OFF EROSION MONITORING

As discussed above, RCRA cap topsoil depth and vegetation cover are key parameters in monitoring cap integrity. Stormwater/snowmelt runoff has the potential for damaging both vegetation cover and topsoil soil depth through erosion of the cap surface. In addition, accumulation (i.e., ponding) of stormwater/snowmelt on the surface of the pond can impact ET cap performance by overwhelming the water storage layer. The objective of the cap run-on and/or run-off erosion monitoring is to determine if water erosion from run-on or run-off has removed or re-distributed topsoil to the extent that the ET cap design capabilities may be impaired. In addition, stormwater/snowmelt diversionary/accumulation systems are inspected to note and remove debris, sediment, or other obstructions. To meet the stormwater/snowmelt monitoring objective, the RCRA pond caps are visually inspected (1) semiannually, (2) within 48 hours of a 25-year, 24-hour storm event defined as 2.1 inches (or more) of precipitation within a 24 hour period (NOAA, 1973) as reported for the Pocatello airport weather station, and (3) within 48 hours of a rain on frozen soil event of 1.0 inch (or more) of precipitation within a 24 hour period as reported for the Pocatello airport weather station during the period November 15 through April 15 to determine if cap surface erosion or ponding has occurred. Diversionary / drainage structures are also inspected for accumulation of debris or sediment. In addition, the cap surface will be visually inspected within 48 hours of a high wind event. A high wind event is defined as a calendar day during which the sustained (1-minute averaging time) maximum wind speed exceeds 70 miles per hour as recorded at the Pocatello airport weather station. The objective of the high wind event visual inspection will be to determine if cap surface erosion and / or accumulation of debris or sediment in the diversion and drainage structures has occurred. This is

a qualitative, rather than quantitative assessment and no routine sampling and analysis is performed as part of this monitoring. The procedures for the stormwater/snowmelt monitoring field activities are presented in Section 4.5 of the *FSP for RCRA Cap Integrity Monitoring* (included in Appendix A-3 of the *Post-Closure Plan*). The stormwater/snowmelt inspections will be summarized in the *RCRA Pond Annual Post-Closure Report*. Any areas of the RCRA pond caps that require maintenance (i.e., repair erosion channels or seeding) will be noted on the Inspection Record Form.

1.5.5 Survey Benchmark Monitoring

Survey benchmarks are used to determine the exact location and dimensions of the RCRA ponds and as reference points while performing the RCRA cap settlement monitoring. The objective of the survey benchmark monitoring is to ensure that the survey benchmarks used to determine the exact location and dimensions of RCRA ponds and to perform the settlement monitoring are properly protected and maintained. This is a qualitative, rather than quantitative assessment and no routine sampling and analysis is performed as part of this monitoring. The procedures for the survey benchmark inspection field activities are presented in Section 4.6 of the *FSP for RCRA Cap Integrity Monitoring* (included in Appendix A-3 of the *Post-Closure Plan*). The survey benchmark inspections will be summarized in the *RCRA Pond Annual Post-Closure Report*. Any survey benchmarks that require maintenance (i.e., damaged, missing, or covered) will be noted on the Inspection Record Form.

1.5.6 RCRA Pond Security Monitoring

40 CFR §265.14(a) requires the owner or operator must prevent the unknowing entry, and minimize the possibility of the unauthorized entry, of persons or livestock onto the active portion of the facility. The RCRA ponds area is wholly enclosed within the boundaries of the FMC plant site which has a combination of fencing around the property boundary, natural barriers and controlled entry. Access to the closed units is and will be controlled to protect the cover, benchmarks, and monitoring systems from inadvertent access of unauthorized persons. The objective of the security system monitoring is to ensure that security systems are in place, functional, and maintained. Security systems for the RCRA ponds include fencing, secured gates, and warning signs. This is a qualitative, rather than quantitative assessment and no routine sampling and analysis is performed as part of this monitoring. The procedures for the RCRA pond security inspection field activities are presented in Section 4.6 of the *FSP for RCRA Cap Integrity Monitoring* (included in Appendix A-3 of the *Post-Closure Plan*). The RCRA pond security inspections will be summarized in the *RCRA Pond Annual Post-Closure Report*. Any RCRA pond security systems that require maintenance will be noted on the Inspection Record Form.

1.5.6 TMP Enclosure and Perimeter Piping Standpipe Monitoring

The Temperature Monitoring Points (TMPs) formerly used for temperature monitoring, housed within locking enclosures, and perimeter piping standpipes formerly used for pressure monitoring or contingent gas extraction, with one standpipe per pond equipped with a pressure transducer, are no longer used for their original purpose. Nonetheless, these physical appurtenances remain and will be monitored annually to ensure they remain intact and are secured. This is a qualitative, rather than quantitative assessment and no routine sampling and analysis is performed as part of this monitoring. The procedures for the TMP enclosure and perimeter pipe standpipe monitoring are presented in Section 4.7 of the *FSP for RCRA Cap Integrity Monitoring*

(included in Appendix A-3 of this *Post-Closure Plan*). The TMP enclosure and perimeter pipe standpipe inspections will be summarized in the *RCRA Pond Annual Post-Closure Report*. Any TMP enclosure and perimeter pipe standpipe issues that require maintenance will be noted on the Inspection Record Form.

1.6 SPECIAL TRAINING REQUIREMENTS/CERTIFICATION

All personnel directly involved in sample collection, handling, analysis, and data evaluation will be provided with a copy of this QAPP and the applicable FSPs. Personnel will be trained in the requirements specified herein, or provided ample time to read and become familiar with the requirements prior to beginning data collection activities. Any persons entering the fenced area containing the closed RCRA ponds will be given training on the *RCRA Pond Area Work Rules* and the *RCRA Facility-Wide Contingency Plan – FMC Idaho, LLC.* Persons directly involved in sampling on the FMC Plant Site will also be required to have hazardous waste operations and emergency response training (HAZWOPER) per the requirement of 29 CFR § 1910.120.

1.7 DOCUMENTATION AND RECORDS

Records of the analyses and evaluations required by this plan will be maintained by FMC at the site throughout the post-closure care period. Laboratory documentation and records requirements are specified in the laboratory QAPP. Required field documentation is specified in the companion FSPs included in Appendix A-2 and A-3.

2.0 DATA GENERATION AND ACQUISITION

This section provides requirements for sampling program design, sample collection, handling, analysis, and data management. These requirements ensure that appropriate methods for sampling, analysis, data handling, and quality control are employed and documented.

2.1 SAMPLING PROCESS DESIGN

2.1.1 SURFACE VEGETATION MONITORING

The cap vegetation cover surveys will be performed annually on the surface of each of the RCRA pond caps. The purpose of the vegetation monitoring is to visually inspect the RCRA pond cap surface to determine if areas void of vegetation are developing. Therefore, the vegetation cover survey will be performed in the fall at the end of the growing season (typically in September or October and just prior to re-seeding, if required). All RCRA ponds will be inspected following the methodology described in Guidelines for Determining Stand Establishment on Pasture, Range and Conservation Seedings (USDA, January 2008). The vegetation monitoring at each RCRA pond cap will consist of three walking transects and counting plants within ten (10) 9 square foot sampling plots per transect. The plant density within each of the total of thirty (30) sample plots will be used to evaluate the adequacy of the vegetative cover on the cap surface. The vegetation count accuracy will be ± 1 plant per 9 square foot plot ("sample").

2.1.2 SETTLEMENT MONITORING

The elevation and coordinates of each monument will be surveyed to determine the vertical and horizontal components of the final cover monuments. Measurements are taken on the monuments annually. For accuracy, a surveying instrument will be used to take measurements with the following tolerances:

- Elevation readings: 0.01 foot
- Horizontal displacement: 0.1 foot

Elevation and displacement measurements will be plotted cumulatively versus time. The time scale will be in logarithm of time or square root of time. The settlement curve will be kept up to date with each reading. The displacement measurements (vertical and horizontal movements) will be made (1) annually; (2) if visible subsidence is noted during semiannual inspections or routine maintenance; and (3) after local seismic events. A triggering seismic event is defined as an event the (1) exceeds a magnitude 5.0 on the Richter Scale with an epicenter within a 20-mile radius as reported by USGS or (2) exceeds a magnitude 6.0 on the Richter Scale with an epicenter within a 50-mile radius as reported by USGS during the remaining post-closure period or until the total cumulative movements for the previous five years are less than the following limits:

- Vertical settlement: 0.03 foot
- Horizontal movement: 0.2 foot

Displacement measurements will be made (1) at least once every five years during the post-closure period after the above limits are reached; (2) if visible subsidence is noted during semiannual run-on and/or run-off erosion monitoring or other monitoring and/or maintenance; and (3) after local seismic events. The criteria for visible subsidence requiring settlement monitoring has been established as an area of 100 square feet (a 10 foot by 10 foot or 11 foot diameter area) or greater where precipitation ponding is observed or could occur to a depth of 1 inch of water or greater. A triggering seismic event is defined as an event the (1) exceeds a magnitude 5.0 on the Richter Scale with an epicenter within a 20-mile radius as reported by USGS or (2) exceeds a magnitude 6.0 on the Richter Scale with an epicenter within a 50-mile radius as reported by USGS. Settlement monitoring will be based on control stations "94-1" and "94-4," which are local stations in FMC's survey control system. The coordinates for these stations were derived from the *U.S. Coast & Geodetic Survey (US C&GS) Control Station MCDOUGAL-2 and BM Y-96*. The vertical datum is based on the 1968 adjustment of the *National Geodetic Vertical Datum of 1929 (NGVD 29) by the US C&GS*.

2.1.3 TOPSOIL DEPTH MONITORING

2.1.3 TOPSOIL DEPTH MONITORING

The "RCRA double cap" design for RCRA Ponds 8S, Phase IV, 15S, 16S and 18 Cell A are equipped with topsoil indicators as these ponds have the ET cap incorporated into the cap design. The topsoil indicators installed on each RCRA pond with an ET cap will be inspected and soil levels recorded (1) annually and (2) within 48 hours of a high wind event to monitor cap erosion. A high wind event is defined as a calendar day during which the sustained (1-minute averaging time) maximum wind speed exceeds 70 miles per hours as recorded at the Pocatello airport weather station. These RCRA ponds are equipped with the following number of topsoil indicators:

- Pond 8S has 7 topsoil indicators
- Phase IV Ponds have 19 topsoil indicators
- Pond 15S has 18 topsoil indicators
- Pond 16S has 18 topsoil indicators
- Pond 18 Cell A has 14 topsoil indicators

When topsoil (loss) measurement reaches 5 inches below the installed thickness at 50-percent of the indicators on a given RCRA pond cap, the total cap area will be evaluated. The topsoil depth measured against the topsoil depth indicators are ± 0.25 inch.

2.1.4 RODENT/INSECT INFESTATION MONITORING

The RCRA pond caps will be visually inspected for evidence of rodent burrowing or loss of vegetation as result of rodent/insect feeding. The rodent/insect infestation monitoring is performed semi-annually by walking around the perimeter of the pond, and then walking equidistant, parallel traverses over the cap surface of the pond. The monitoring is a visual observation of evidence of rodent burrowing or loss of vegetation has occurred. This is a qualitative, rather than quantitative assessment.

2.1.5 ET CAP DRAINAGE MONITORING

The ET cap drainage monitoring will be performed annually at each of the RCRA ponds that are equipped with a "RCRA double cap" that incorporate an ET cap (as installed on subject RCRA Ponds 8S, Phase IV, 15S, 16S and 18 Cell A). The purpose of the ET drainage monitoring is to determine and record the volume and rate of ET cap drainage collected at each of these ponds on a annual basis. Each of these ponds is equipped with one or more ET cap drainage collection sumps as listed below:

- Pond 8S has 2 cap drainage collection sumps;
- Phase IV Ponds have 4 cap drainage collection sumps;
- Pond 15S has 2 cap drainage collection sumps;
- Pond 16S has 2 cap drainage collection sumps; and
- Pond 18 Cell A has 2 cap drainage collection sumps.

A calibrated dipstick will be used to measure the water level in the sump and record the sump level. The sumps have been calibrated to provide depth vs. volume conversions. The volume measurements will be ± 1.0 gallon. The measured annual seepage rate, which represents the percolation at the drainage layer at the bottom of the capillary barrier, will be compared to the maximum annual percolation of 10-4 in/yr predicted by the UNSAT-H model for the simulated 600 year period for each individual RCRA pond.

2.1.6 LCDRS MONITORING

LCDRS monitoring is performed on a progressive, step-wise schedule per 40 CFR § 265.226(b)(2) on RCRA ponds that are equipped double liners (as installed on RCRA Ponds 8E, 9E, 15S, 16S, 17, and 18 Cell A). The LCDRS for each RCRA pond equipped with LCDRS is described below:

- Pond 8E is equipped with 1 LDCRS collection sump.
- Pond 9E is equipped with 6 LDCRS collection sumps.
- Pond 15S is equipped with 4 LDCRS collection sumps.
- Pond 16S is equipped with 2 LDCRS collection sumps.
- Pond 17 is equipped with 1 LDCRS collection sump.

- Pond 18 Cell A is equipped with 1 LDCRS collection sump.

2.1.7 GROUNDWATER ASSESSMENT MONITORING

The groundwater monitoring system wells sampling frequency and parameters of concern have developed over the history of the monitoring program and are documented in *RCRA Interim Status Groundwater Monitoring Assessment Reports*. RCRA pond monitoring wells, as identified in Table 2.0 are sampled on a quarterly basis and analyzed for the parameters of concern as detailed on Tables 3.1 and 3.2. The indicator constituent (As, K, Se) concentrations for each monitoring (calendar) year will be evaluated using a three step statistical test as follows:

As recommended by the EPA (James Brown, Office of Solid Waste, May 5, 1993), and consistent with the EPA's guidance documents for Statistical Analysis of Groundwater Monitoring Data at RCRA Facilities (EPA, 1989, 1992, 2009), the 2009 indicator constituent concentrations were analyzed as they were in previous years using a defined set of statistical procedures: the non-parametric Mann-Whitney U-test (rank-sum test) to compare the central tendency (median) of two data sets, and a comparison of mean concentrations. Details of the Mann-Whitney method are provided in the "RCRA Interim Status Groundwater Monitoring Assessment Report" (FMC, August 1993). Statistical testing procedures are as follows:

Test 1) For each WMU, the arsenic, potassium, and selenium concentrations in upgradient wells will be compared to those in the downgradient wells using the Mann-Whitney U-test. The test will be performed using a significance level $\alpha = 0.05$ (i.e., if the test yields a p-value less than 0.05, the null hypothesis will be rejected and the median concentrations of upgradient and downgradient wells will be considered to be significantly different). The α-value of 0.05 sets the Type I error rate at 5%; that is, the risk that the medians will be considered significantly different through statistical testing, even though they are not is 5%. This is typically an acceptable rate as described in guidance and other sources (Gilbert, 1987 and EPA, 1989 and 2009). In many cases, constituent concentrations are expected to be higher in the downgradient wells because of the presence of former unlined ponds underlying or adjacent to certain WMUs. As discussed in FMC's RCRA annual assessment reports (FMC, August 1993; February 1994 through February 2010) and the Groundwater Current Conditions Report for the FMC Plant Operable Unit (FMC, June 2009), results showing statistically higher downgradient concentrations using this analysis do not necessarily indicate current impacts from the WMUs, and in certain cases may instead be attributable to prior practices at the former ponds. Consequently, an additional test (Test 2) is also conducted for downgradient wells for each WMU.

Test 2) For each downgradient well, the current monitoring year mean concentrations of arsenic, potassium, and selenium will be compared to prior year mean concentrations. If the current monitoring year mean concentrations are less than or equal to prior years mean concentrations, the concentrations of the measured constituent are not increasing at that well,and therefore result in a conclusion that no leakage of contaminants from the WMU is occurring. If the results of Test 1 indicated that concentrations in downgradient wells are significantly higher than those of upgradient wells, and the

results of Test 2 are inconclusive or indicated that the current monitoring year mean is higher than the prior years mean for any individual downgradient well, then Test 3 will be conducted.

Test 3) The Mann-Whitney U-test will be performed for downgradient wells at each WMU to compare concentrations observed in the current monitoring year with concentrations observed in prior years. This test is intended to determine if data for a constituent shows a statistically significant increase through time by comparing the median concentrations of the current year and prior years data sets. As with Test 1, Test 3 will be performed using a significance level $\alpha = 0.05$.

It should be noted that, for purposes of the three statistical tests described above, data reported as less than the analytical detection limit will be removed from the database prior to performing statistical testing on the data set.

The pH meter, water level meter, and water temperature measurements are ± 0.2 pH units, ± 0.01 ft, and ± 0.15 ° C respectively of actual value. The specific conductance measurements will be within 0.5% or 1 µmhos/cm and turbidity measurements will be within + 2% of actual value.

2.1.6 RUN-ON AND RUN-OFF EROSION MONITORING

The cap stormwater/snowmelt monitoring is performed (1) semiannually, (2) within 48 hours of a 25-year, 24-hour storm event defined as 2.1 inches (or more) of precipitation within a 24 hour period (NOAA, 1973) as reported for the Pocatello airport weather station, and (3) within 48 hours of a rain on frozen soil event of 1.0 inch (or more) of precipitation within a 24 hour period as reported for the Pocatello airport weather station during the period November 15 through April 15 to determine if cap surface erosion or ponding has occurred by walking around the perimeter of the pond, and then walking equidistant, parallel traverses over the cap surface of the pond. This monitoring is a visual identification of areas where topsoil erosion, lack of vegetation as result of erosion, and/or ponding of water on the cap surface is present. Diversionary / drainage structures are also inspected for accumulation of debris or sediment. In addition, the cap surface will be visually inspected within 48 hours of a high wind event. A high wind event is defined as a calendar day during which the sustained (1-minute averaging time) maximum wind speed exceeds 70 miles per hour as recorded at the Pocatello airport weather station. The objective of the high wind event visual inspection will be to determine if cap surface erosion and / or accumulation of debris or sediment in the diversion and drainage structures has occurred. This is a qualitative, rather than quantitative assessment.

2.1.7 SURVEY BENCHMARK MONITORING

The survey benchmark monitoring is performed annually by visually inspecting all survey benchmark control stations used to determine the exact location and dimensions of the RCRA ponds and as reference points while performing the RCRA cap settlement monitoring. This is a qualitative, rather than quantitative assessment.

2.1.8 RCRA POND SECURITY MONITORING

RCRA pond security monitoring is performed semiannually by visually inspecting all fences, gates, and warning signs associated with the RCRA pond security system. This is a qualitative, rather than quantitative assessment.

2.1.9 TMP ENCLOSURE AND PERIMETER PIPING STANDPIPE MONITORING

This monitoring is performed annually by visually inspecting the TMP enclosures and perimeter pipe standpipes at the RCRA ponds. This is a qualitative, rather than quantitative assessment.

2.2 SAMPLING METHODS

The groundwater monitoring wells associated with each RCRA pond will be sampled in accordance with the detailed procedures presented in the *FSP for RCRA Groundwater Monitoring* as included in Appendix A-2 of the *Post-Closure Plan*. All other sampling/measurements associated with cap monitoring will be performed in accordance with the detailed procedures in the *FSP for Cap Monitoring* as included in Appendix A-3 of the *Post-Closure Plan*.

2.3 SAMPLE HANDLING AND CUSTODY

Sample handling and custody only applies to samples being submitted to an off-site analytical laboratory, e.g., the groundwater monitoring samples and waste determination samples. All other sampling and data collection covered by the QAPP is performed using field instrumentation or direct observation. The groundwater samples will be handled and custody will be maintained in accordance with the detailed procedures presented in Section 6 of the FSP *for RCRA Groundwater Monitoring*. Waste determination samples will be handled and custody will be maintained in accordance with standard practices necessary to comply with 40 CFR § 262.11.

2.4 ANALYTICAL METHODS

Sample analytical methods only apply to samples being submitted to an off-site analytical laboratory, e.g., the groundwater monitoring samples and waste determination samples. All other sampling and data collection covered by the QAPP is performed using field instrumentation or direct observation. Waste determination samples will be analyzed in accordance with established analytical methods necessary to comply with 40 CFR § 262.11.

2.4.1 ANALYSIS OF GROUNDWATER SAMPLES

The analytical methods that will be used on groundwater monitoring samples are summarized in Table 3.1. The table specifies method number, method type, and method detection limit ranges. Method detection limits presented on this table for each analysis represent the best reporting limits that can be attained by the specified methodology. Data from multiple dilutions will be used, as necessary, to quantify target components within the calibrated range. Actual detection

limits obtained during analysis will be reported by the laboratory for each parameter in each sample.

The laboratory performing the analyses will have an established quality assurance/quality control (QA/QC) plan and all analyses will be performed in accordance standard operating procedures consistent with the QA/QC plan. Where analytical or QA/QC procedures presented in the QAPP are different from those presented in the laboratory QA/QC plan, procedures presented in this QAPP will govern.

2.5 QUALITY CONTROL

For groundwater samples, both field and laboratory QC checks will be employed to evaluate field contamination, the variability of field techniques and the performance of laboratory analytical procedures. QC checks will take the form of samples introduced into the analytical stream to enable evaluation of sampling and analytical accuracy and precision.

Such QC samples will be regularly prepared in the field and laboratory so that all phases of the sampling process are monitored. The following subsections describe the QC samples that will be collected.

Sections 2.6 and 2.7 describe the instrument/equipment testing, inspection, calibration and maintenance requirements.

2.5.1 FIELD QUALITY CONTROL SAMPLES

Field Duplicates - Field duplicate samples will be collected for use as a measure of the precision of the sample collection and analysis process. The duplicate will be submitted with minimal indication of the site it was taken from. Duplicates will be prepared following standard sampling and preparation techniques as described in the FSP and submitted to the laboratory at a minimum frequency of one per sample delivery group or every 20 samples.

Rinsate Blanks - Rinsate blanks are collected by pouring reagent grade purified water over or through submersible pump setups to evaluate the effectiveness of field decontamination of sampling equipment. The blank is analyzed for the same analytical parameters as the groundwater samples. Rinsate blanks will be collected after decontamination and at a minimum frequency of one per sample delivery group or every 20 samples.

Distilled or De-ionized Water Blank – Distilled or de-ionized water blanks are aliquots of water collected directly from the field supply container and analyzed to determine distilled / de-ionized water quality. The blanks are collected at a frequency of one per semi-annual sampling event and are analyzed for the same parameters as the groundwater samples. The distilled or de-ionized blanks are collected in conjunction with the CERCLA and Calciner Pond Remedial Action groundwater monitoring programs (i.e., one distilled or de-ionized water blank per sampling event concurrently satisfies requirement for all three monitoring programs).

2.5.2 MATRIX SPIKE / MATRIX SPIKE DUPLICATE QUALITY CONTROL SAMPLES

Matrix spike / matrix spike duplicate (MS/MSD) quality control samples will also be collected at a frequency of one per sample delivery group or one per twenty samples collected. The well(s) designated for a MS/MSD quality control sample will be randomly selected during each monitoring event from the RCRA program monitoring wells.

2.5.3 LABORATORY QA/QC SAMPLES

Laboratory QC samples consist of laboratory method blanks, laboratory control samples, matrix spike, and laboratory duplicates or matrix spike duplicates. Requirements for laboratory QC samples are specified in the Laboratory's Quality Assurance Project Plan.

For method-specific QC criteria and samples (e.g. calibration blanks or initial calibrations), the criteria specified in the methods will be used. The methods will be performed as written. Any deviations, if allowed, must be approved by the FMC Environmental Manager in writing prior to implementation by the laboratory. Procedures will be in place for demonstrating that the laboratory is in control during each analytical measurement.

Laboratory Control Samples - The laboratory will be considered in control when data generated by analysis of control samples fall within laboratory prescribed limits. Data generated by analysis of control samples that falls outside the established control limits are judged to be generated during an "out-of-control" situation. These data are considered suspect and will be repeated or reported with qualifiers. Laboratory control samples will be analyzed for each analytical method when appropriate for the method. A laboratory control sample consists of either a control matrix spiked with the analytes of interest for this program or a certified reference material that contains the analytes of interest. Laboratory control sample(s) will be analyzed with each batch of samples processed to verify that the precision and bias of the analytical process are within control limits. The results of the laboratory control sample(s) will be compared to control limits established by the laboratory for both precision and bias to determine usability of the data.

Method Blank - A method blank will be analyzed with each batch of samples processed to assess contamination levels in the laboratory. The laboratory will have guidelines in place for accepting or rejecting data based on the level of contamination in the blank. For a method blank to be acceptable for use with the accompanying samples, the concentration in the blank of any analyte of concern will not be higher than the highest of either:

- The MDL, or
- Five percent of the regulatory limit for that analyte, or
- Five percent of the measured concentration in the sample.

Matrix Spike/Matrix Spike Duplicates for Matrix Duplicate Samples - Procedures will be in place for documenting the effect of the matrix on method performance. When appropriate for the

method, there will be at least one matrix spike (MS) and either one matrix duplicate (MD) or one matrix spike duplicate (MSD) per analytical batch. These procedures will include preparation and analysis of matrix spikes and the method of standard additions for metal and inorganic methods. When the concentration of the analyte in the sample is greater than 0.1% (1,000 ppm), no spike is necessary. Procedures will be in place for determining the precision of the method for a specific matrix. These procedures will include analysis of matrix duplicates and/or matrix spike duplicates.

If the concentration of a specific analyte in the sample is being checked against a regulatory concentration limit or action level, the spike will be at or below the limit, or 10 times the background concentration (if historical data are available), whichever concentration is higher.

If the concentration of a specific analyte in a sample is not being checked against a limit specific for that analyte, then the analyst may spike the sample at the same concentration as the reference sample, at 20 times the estimated quantitation limit (EQL) in the matrix of interest, or at a concentration near the middle of the calibration range.

2.6 INSTRUMENT/EQUIPMENT TESTING, INSPECTION, AND MAINTENANCE REQUIREMENTS

All equipment used in the conduct of this work will receive routine maintenance checks in order to minimize equipment breakdowns. Laboratory equipment is tested, inspected, and maintained in accordance with an established QA/QC plan.

All equipment used in the conduct of the groundwater monitoring will receive routine maintenance checks in order to minimize equipment breakdowns. Maintenance checks will generally coincide with calibration checks. Any equipment found to be operating improperly will be taken out of use, and a notation stating the time and date of this action will be made in a groundwater monitoring log book. The equipment will be repaired, replaced or recalibrated, as necessary, and the time and date of its return to service will also be recorded. Groundwater monitoring equipment will be inspected and maintained as shown on Table 4.0.

Table 4.0

GROUNDWATER MONITORING EQUIPMENT INSPECTION AND MAINTENANCE ACTIVITIES

Inspection Item	Inspection Frequency	Maintenance Action
Field equipment	Quarterly	Repair or replace defective/damaged equipment
Laboratory equipment	Quarterly	Recalibrate; repair or replace defective equipment in accordance with Laboratory QA/QC Plan

2.7 INSTRUMENT/EQUIPMENT CALIBRATION AND FREQUENCY

The requirements in this section pertain to the calibration of field equipment. Laboratory equipment will be calibrated in accordance with an established QA/QC plan and all calibrations will be performed in accordance standard operating procedures consistent with the QA/QC plan.

Additional requirements related to laboratory instrument calibrations and frequency requirements are specified in the laboratory QA/QC plan. All calibrations of field equipment will be recorded in the groundwater monitoring log book. Table 5.0 provides a summary of groundwater monitoring field equipment calibration requirements.

2.8 INSPECTION/ACCEPTANCE REQUIREMENTS FOR SUPPLIES AND CONSUMABLES

Groundwater sample containers will be new or pre-cleaned and supplied by the laboratory performing sample analysis. All other supplies will be decontaminated prior to use in accordance with the equipment decontamination procedure presented in the applicable FSP. No consumable supplies are required to execute the temperature and pressure monitoring program.

2.9 DATA ACQUISITION REQUIREMENTS (NON-DIRECT MEASUREMENTS)

To meet groundwater and cap monitoring objectives at the FMC Facility, no data from non-direct measurements are required.

2.10 DATA MANAGEMENT

Data from both the field and the laboratory will be managed during this project. Field data will consist of field notebooks and chain of custody forms. Notebooks and chain of custody forms will be retained by the groundwater sampling contractor until the end of each quarterly sampling event, then forwarded to the FMC Environmental Manager for retention.

The laboratory documentation required for each sample delivery group depends on the anticipated level of review. Section 2.10.1 presents the documentation requirements of data validation and Section 2.10.2 presents the documentation requirements for data review. The Groundwater Sampling Contractor will maintain the analytical database.

Field documentation is presented in Section 2.10.3.

2.10.1 LABORATORY DOCUMENTATION FOR DATA VALIDATION

The following documentation will be provided by the laboratory for each sample delivery group scheduled for validation:

1. Case Narrative
2. Chain of Custody Documentation
3. Summary of Results
4. QA/QC Result Summaries
5. Raw Data

The format and detailed content of the laboratory documents will support validation of the data in accordance with EPA Contract Laboratory Program National Functional Guidelines for

Inorganic Data Review (EPA 1994). An electronic data deliverable will be provided by the laboratory in a file format specified by FMC that is compatible with dBase III software. The deliverable will contain the fields specified in Table 6.0. Data packages for full validation will be forwarded by the laboratory to the data validation contractor. At the same time, a copy of items 1 through 4 will be forwarded to the FMC Environmental Manager for retention.

2.10.2 Laboratory Documentation for Data Review

Each sample delivery group of laboratory data not planned for validation will include items 1 through 4 described above in the same level of detail as required if the data were to be validated. Item 5, Raw Data, is not required. An electronic data deliverable will be provided by the laboratory in a file format specified by FMC. The deliverable will contain the fields specified in Table 6.0. Items 1 though 4 will be forwarded to the FMC Environmental Manager for retention.

2.10.3 Field Measurement Documentation

All information pertinent to the field activities will be entered directly onto the field inspection form(s). Information entered onto the field inspection form will include:

- Date, sampling event start time, weather conditions, personnel on site, and instrument calibration information.
- Descriptions of all field activities and procedures including any deviations from the FSP's.

In addition to written records, photographs also may be taken as necessary to supplement written descriptions of field activities entered on the field inspection form(s). Photographs will be included in project reports, where appropriate, and will be stored with the permanent project files.

3.0 Assessment/Oversight

Periodic surveillance of monitoring activities will be conducted. The surveillance will be conducted by the FMC Site Project Manager or his/her designee. The field surveillance will focus on adherence to standard procedures and will include field observation of sampling procedures and selected documentation. Laboratory audits will be conducted in accordance with the laboratory quality assurance plan. Field surveillance reports and laboratory audit reports will be forwarded to the FMC Remediation Director. Audit findings which require corrective action and follow-up will be documented and tracked and will have resolution verified by the FMC Site Project Manager.

3.1 ASSESSMENTS AND RESPONSE ACTIONS

If it appears that field or laboratory data are in error, the error(s) or potential error(s) will be documented and appropriate corrective action(s) will be taken. Corrective actions may include one or more of the following:

- Measurements may be repeated to check the error
- Calibrations may be checked and/or repeated
- Instrument/equipment may be replaced or repaired
- New samples may be collected, and/or samples may be reanalyzed.

All field and laboratory personnel will be responsible for identification of problems and implementation of corrective actions. During field and laboratory activities, problem descriptions and corrective actions taken will be thoroughly detailed and entered onto field inspection forms or laboratory notebooks.

If the FMC Site Project Manager, Analytical Laboratory Contractor QA officer, or other project personnel become aware of any problems in sample collection or analysis that cannot be corrected in the field or laboratory, they will initiate formal corrective action. . The FMC Site Project Manager will also be notified of problems identified and corrective actions taken during field activities. Appropriate corrective actions will be determined on a case-by-case basis.

3.2 REPORTS TO MANAGEMENT

The surveillance and audit findings will be included in the corresponding groundwater quarterly groundwater monitoring results and data validation reports. Each report, as appropriate, will include a section which provides an overall assessment of the performance of the field and laboratory programs based on the audits.

4.0 Data Validation and Usability

The following subsection presents requirements for activities that occur after the data collection phase of the project is complete.

4.1 DATA REVIEW, VALIDATION, AND VERIFICATION REQUIREMENTS

For laboratory generated analytical data, ten percent of the analytical results or one sample delivery group, whichever is greater, will be validated. The other ninety percent will receive a QC and Blank Check to ensure the sampling and analytical program are operating within control limits. The QC and Blank Check will include examination of field duplicate sample results and laboratory QA/QC sample results. All electronic copy entries will be verified against hard-copy results reported by the laboratory and field sampling personnel, unless the electronic copy is produced using the same laboratory information management system.

The FMC Site Project Manager or designee will assess the usability of the data generated pursuant to the RCRA Pond Post-Closure Plan as follows:

- Review the validated laboratory analytical data and quantitative field data (e.g., depth to water and field parameter measurements during groundwater monitoring) in terms of the DQOs as described in Tables 1.1 and 1.2 and consistency with prior results and any trends.

- Review the non-quantitative field data qualitatively in terms of the DQOs as described in Tables 1.1, 1.2, and 1.3.

4.2 VALIDATION AND VERIFICATION METHODS

The required data review may be conducted informally during report preparation; it should include a comparison of the current and previous quarter results. The QC and Blank Check will be conducted by compiling the results of field duplicate samples and laboratory QA/QC samples and assessing whether the sampling and analytical processes are operating within control limits. Generally, these processes are considered within control limits if the relative percent difference between field duplicate pairs is less than 30 percent and if the laboratory QA/QC sample results meet the criteria specified in the applicable method. Data validation will be conducted in accordance with the EPA Contract Laboratory Program National Functional Guidelines for Inorganic Data Review (EPA, 1994), Contract Laboratory Program National Functional Guidelines for Inorganic Data Review, Final (EPA, July 2002), and Guidance on Environmental Data Verification and Data Validation (EPA, November 2002).

4.3 RECONCILIATION WITH USER REQUIREMENTS

To meet the project objectives specified in Section 1.3.2, the data analyses specified in DQO Step 5 of this QAPP will be performed. If sufficient data of known quality have been generated to complete these analyses, then the project objectives have been met. If insufficient data of known quality have been generared (i.e., significant rejected results) to complete these analyses, then the project objectives have not been met and corrective action will be required to complete the analyses. Appropriate corrective actions will be determined on a case-by-case basis but may include re-measurement or re-sampling / laboratory analysis.

5.0 References

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Table 1.1
RCRA POST CLOSURE PLAN DATA QUALITY OBJECTIVES (DQOs)
RCRA Pond Cap Integrity Monitoring

DQO Step	Vegetation Monitoring	Settlement Monitoring	Topsoil Depth Monitoring	Rodent/Insect Monitoring	ET Cap Drainage Monitoring
State the Problem					
Problem Statement	In order to maintain cap performance, vegetation on the cap surface will be monitored and maintained.	In order to monitor cap settlement and movement, settlement monuments will be monitored and maintained.	In order to maintain ET cap performance, topsoil erosion losses (from wind and/or stormwater runoff) will be monitored. Topsoil depth indicators will be inspected and maintained. Note that closed RCRA Ponds 8E, 9E, and 17 do not have ET caps or associated topsoil depth indicators.	In order to maintain cap performance, impacts of rodents and/or insects will be monitored on the cap surface, i.e., burrowing or loss of vegetation.	In order to monitor ET cap performance, precipitation percolation through the ET cap (cap drainage) will be monitored, measured and recorded. The cap drainage monitoring systems will be inspected and maintained. Note that closed RCRA Ponds 8E, 9E, and 17 do not have ET caps or associated cap drainage systems.
Relevant Deadlines	Vegetation monitoring on the cap surface will be conducted annually, as specified in the Field Sampling Plan.	Displacement measurements will be made (1) annually until the defined vertical and horizontal displacement limits are reached and then at least once every five years during the post-closure period; (2) if visible subsidence is noted during semiannual run-on and/or run-off erosion monitoring or other monitoring and/or maintenance; and (3) after local seismic events, as specified in the Post-Closure Plan.	Topsoil depth monitoring on the cap will be conducted semiannually and within 48 hours of each triggering high wind events (provided soil depth gauges are accessible), as specified in the Post-Closure Plan.	Cap surface will be monitored for evidence of rodent and/or insect activity (including dirt mounds, distressed vegetation, etc.) semi-annually, ground surface conditions permitting.	The ET cap drainage system will be inspected annually and annual seepage volume will be measured and recorded as specified in the Post-Closure Plan.
Identify the Decision					
Principal Study Question	Is the vegetation cover on the cap surface adequate (given climatic conditions in Southeast Idaho) such that the ET cap is capable of performing as designed and/or that surface topsoil erosion will be minimized?	Is settlement/movement of the pond cap surface is less than or equal to the expected design settlement rates?	Is loss of topsoil (through wind or runoff erosion) on the ET cap surface is less than or equal to design as an indicator that the ET cap is capable of performing as designed.	Is rodent/insect activity is controlled such that the cap integrity/performance is not jeopardized.	Is the precipitation percolation rate through the ET cap at or below predicted infiltration rates on which the ET cap design was based.
Alternative Actions	Evaluation of surface vegetation will be used to demonstrate that cap evapotranspiration rates are acceptable and that erosion potential is minimized.	Evaluation of settlement/movement on the RCRA pond cap surface will be used to demonstrate that the capping materials are settling at or near expected design rates.	Evaluation of topsoil loss on the RCRA pond cap surface will be used to demonstrate that the evapotranspiration storage of the ET cap is adequate.	Monitoring of the cap topsoil surface for evidence of excessive rodent/insect activity will be used to identify and correct excessive rodent/insect activity.	Cap drainage accumulation volumes will be used to demonstrate the ET cap is performing as designed. All cap drainage water will be properly disposed as discussed in Section 5 of the *RCRA Pond Post-Closure Plan*.
Identify the Decision Inputs					
Physical Inputs	Survey of vegetation density on the cap surface consisting of 3 transects and 10 plots (“samples”) per transect.	Vertical and horizontal displacement measurement at each settlement monument.	Vertical depth measurement of topsoil at each topsoil depth indicator.	Visual check for any signs of excessive rodent or insect activity.	The annual volume of cap drainage water accumulated and measured in the cap drainage sump.
Chemical Inputs	None.	None.	None.	None.	None.
Action Levels	Sixty seven percent (67%) of the total 30 samples meet or exceed the target density of 0.5 plants per square foot on the cap surface.	If the total cumulative movement on any given RCRA cap is less than the following limits for five consecutive years, then settlement monitoring frequency will be reduced to once every 5 years for the duration of the post-closure monitoring period: - Vertical = 0.03 ft - Horizontal = 0.2 ft	When measured topsoil loss exceeds 5 inches at 50% of the topsoil indicators on a given RCRA cap, the total cap area will be evaluated.	Any unusual or excessive burrowing or soil mounding. Any rodent/insect impacts on vegetation resulting in unacceptable coverage per vegetation monitoring criteria.	Volume of cap drainage on any given ET cap exceeds the values presented in Table 3.0 in Section 4.3.5 of the FSP.

Table 1.1
RCRA POST CLOSURE PLAN DATA QUALITY OBJECTIVES (DQOs)
RCRA Pond Cap Integrity Monitoring

DQO Step	Vegetation Monitoring	Settlement Monitoring	Topsoil Depth Monitoring	Rodent/Insect Monitoring	ET Cap Drainage Monitoring
Define the Study Boundaries					
Temporal Boundary	Vegetation monitoring on the cap surface will be conducted annually throughout the post-closure period.	Settlement monitoring on the cap surface will be conducted annually.	Topsoil depth monitoring on the cap will be conducted annually throughout the post-closure period.	Cap surface will be monitored for evidence of rodent and/or insect activity semi-annually, ground surface conditions permitting, throughout the post-closure period.	The ET cap drainage system will be inspected and the volume of liquid measured annually, and pumped as needed throughout the post-closure period.
Horizontal Boundary	The geographical boundaries of the cap surface.	The geographical boundaries of the cap surface.	The geographical boundaries of the cap surface.	The geographical boundaries of the cap surface.	The geographical boundaries of the cap surface and associated cap drainage collection system piping and sumps.
Vertical Boundary	The cap surface.	The cap surface.	The ET cap surface.	The cap surface.	The ET cap surface down to the drainage layer of the ET cap.
Develop the Decision Rule					
Parameter of Interest	Vegetation density on the cap surface.	Vertical and horizontal displacement at the settlement monuments.	Depth of topsoil at the topsoil depth indicators.	Not applicable.	Volume of cap drainage water accumulated at the cap drainage sump.
Decision Rule	Decision Rule: If less than sixty seven percent (67%) of the total 30 samples meet or exceed the minimum target density of 0.5 plants per square foot on the cap surface, take corrective action (i.e., reseeding) in the fall (typically October).	Decision Rule a: If the total cumulative movement on any given RCRA cap is less than the action levels for five consecutive years, then settlement monitoring frequency will be reduced to once every 5 years for the duration of the post-closure monitoring period. Proceed to Decision Rule b. Decision Rule b: If the settlement monument is damaged, buried, or inaccessible, take corrective maintenance action as soon as practicable.	Decision Rule a: If the total measured topsoil loss exceeds 5 inches at 50% of the topsoil indicators on a given RCRA cap, the total cap area will be evaluated. Proceed to Decision Rule b. Decision Rule b: If the topsoil depth indicator is damaged, take corrective maintenance action as soon as practicable.	Decision Rule: If there is any evidence of excessive or unusual rodent or insect activity that could negatively impact cap function, take corrective action as soon as practicable.	Decision Rule a: If measured annual accumulation volume of cap drainage is greater than the predicted volume for a given ET cap, check drainage system for improper function and take corrective action as appropriate. Proceed to Decision Rule b. Decision Rule b: If measured accumulation volume of cap drainage is greater than the predicted volume for a given ET cap, after corrective actions on the system, evaluate ET cap.
Specify Tolerance Limits on Decision Errors					
Tolerance Limits	Plant count within each plot = $\pm$ 1 plant	Elevation readings = ±0.01 foot Horizontal displacement = ±0.1 foot	Depth measurements = ±0.25 inches	Not applicable.	Volume of cap drainage accumulation = ±1.0 gallon.
Optimize the Design for Obtaining Data					
Sample Design	The data collection design is described in the Cap Monitoring Field Sampling Plans in Appendix A-3 of the *RCRA Pond Post-Closure Plan.*	The data collection design is described in the Cap Monitoring Field Sampling Plans in Appendix A-3 of the *RCRA Pond Post-Closure Plan.*	The data collection design is described in the Cap Monitoring Field Sampling Plans in Appendix A-3 of the *RCRA Pond Post-Closure Plan.*	The data collection design is described in the Cap Monitoring Field Sampling Plans in Appendix A-3 of the *RCRA Pond Post-Closure Plan.*	The data collection design is described in the Cap Monitoring Field Sampling Plans in Appendix A-3 of the *RCRA Pond Post-Closure Plan.*

Table 1.2
RCRA POND POST CLOSURE PLAN DATA QUALITY OBJECTIVES (DQOs)
Protection of Groundwater

DQO Step	Groundwater Monitoring	LCDRS Monitoring
State the Problem		
Problem Statement	An objective process is needed to evaluate groundwater flow patterns and potential changes and/or trends in pond-related groundwater constituents in order to evaluate whether the closed RCRA pond has impacted groundwater quality.	Systematic procedures are needed to maintain, monitor, and pump and discharge the LCDRS system as required by RCRA regulations to evaluate the integrity of the pond lining system and potential for releases to the subsurface at the closed RCRA pond. Note that closed RCRA Pond 8S and the Phase IV Ponds do not have a functional LCDRS in place.
Relevant Deadlines	Groundwater will be monitored (depth to groundwater and sampled and analyzed quarterly, as specified in the Field Sampling Plan	The LCDRS will be inspected on the scheduled prescribed in 40 CFR § 265.226(b)(2), and pumped as needed to maintain minimum liquid levels as the LCDRS sump. All volumes removed will be recorded as specified in the Post-Closure Plan.
Identify the Decision		
Principal Study Question	Determine whether the concentration or value of selected parameters in the groundwater monitoring data at a the RCRA pond indicate a release of a waste constituent into the groundwater requiring further evaluation and potential notification to EPA Region 10 or continue quarterly sampling as planned for the RCRA pond.	Determine whether or not the volume of leachate collected (and leachate constituents as appropriate) at the LCDRS is increasing over time indicating a leak through the primary pond liner requiring further evaluation and potential notification to EPA Region 10 or continue LCDRS monitoring on the frequency specified by RCRA regulation.
Alternative Actions	Evaluation of groundwater monitoring data will be used to demonstrate there has been no release of waste constituents into groundwater.	Leachate accumulation volumes (and leachate constituents as appropriate) will be used to demonstrate there has been no release of pond wastes through the primary pond liner. All leachate will be properly disposed as discussed in Section 5 of the *RCRA Pond Post Closure Plan*.
Identify the Decision Inputs		
Physical Inputs	Groundwater elevation data and analytical results from groundwater samples collected from the wells specified in Table 1.0.	The volume (and analytical results as appropriate) of leachate pumped from the LCDRS.
Chemical Inputs	The informational inputs required to address the Decision Statements are reported in Tables 4.0 and 5.0. They include: Constituents/Parameters of Concern (COCs), Analytical Methods, Detection Limits, and Data Quality Indicators.	None. However, in the event of increasing volume trends (or other field observations), analysis of the collected leachate may be performed to determine if the leachate contains chemical constituents indicative of pond wastes. All or some of the same chemical parameters as listed in the groundwater analytical parameters in Table 3.1 will be used.
Action Levels	The action levels for the indicator parameters are dependent of the specific monitored unit and comparison of upgradient and downgradient concentrations and results of the test for trend evaluations.	No specific action levels. However, monitoring frequency is determined based on frequency of exceeding the "pump operating level" as prescribed in 40 CFR § 265.226(b)(2).
Define the Study Boundaries		
Temporal Boundary	RCRA regulations require groundwater monitoring to be performed on a quarterly basis. The quarterly sample events are reported in an annual groundwater assessment report. The groundwater monitoring program will continue throughout the post-closure period.	RCRA regulations require LCDRS monitoring/pumping to be performed on a monthly to semi-annual basis, depending on maintaining the "pump operating level". All RCRA ponds are currently on a quarterly LCDRS monitoring/pumping frequency, however, inspection and pumping frequency will follow a progressive, step-wise schedule as prescribed in 40 CFR § 265.226(b)(2). The LCDRS monitoring/pumping program will continue throughout the post-closure period.
Horizontal Boundary	The geographical boundaries of the in-place waste in each RCRA pond and the locations of the upgradient and downgradient monitoring wells.	The geographical boundaries of the in-place LCDRS at each RCRA pond.
Vertical Boundary	The upper groundwater zone (uppermost aquifer).	The vertical depth between the primary and secondary liners at each RCRA pond.
Develop the Decision Rule		
Parameter of Interest	Groundwater elevations and constituent concentration in groundwater.	Volume of leachate accumulation during the monitoring period.

Table 1.2
RCRA POND POST CLOSURE PLAN DATA QUALITY OBJECTIVES (DQOs)
Protection of Groundwater

DQO Step	Groundwater Monitoring	LCDRS Monitoring
Decision Rule	Decision Rule a: If the concentration a groundwater indicator parameter indicates a statistically significant increase from the previous years' monitoring data for a RCRA pond, then further evaluation is necessary to determine if a release at the RCRA pond has occurred. Proceed to Decision Rule b.	Decision Rule a: If the volume of leachate accumulation at a given LCDRS increases from one monitoring period to the next, evaluate potential sources. Record in monitoring records and report in annual report. Proceed to Decision Rule b.
	Decision Rule b: The concentration of arsenic (As), potassium (K), or selenium (Se) as indicator constituents will be evaluated to determine if a statistically significant release has occurred from a RCRA pond using the following statistical tests:	Decision Rule b: If the volume of leachate accumulation at a given LCDRS exceeds the "pump operating level" during any monitoring period, the monitoring frequency for that LCDRS must revert to a monthly monitoring frequency and the progressive step-wise schedule will re-start.
	Test 1: Concentrations of indicator constituents (As, K and Se) in the downgradient wells are statistically higher than the corresponding concentrations in the upgradient wells as computed using the Mann-Whitney U-test, and	
	Test 2: Mean concentration of the indicator constituents (As, K and Se) for the current year is higher than the previous years' corresponding mean concentrations or is inconclusive as computed using software integrated into Microsoft Excel, and	
	Test 3: Concentrations of indicator constituents (As, K and Se) in all the downgradient wells are statistically increasing with time as computed using the Mann-Whitney U-test; then, evaluation of a release from the WMU will be considered and the EPA will be notified, otherwise continue quarterly groundwater monitoring as planned for the WMU.	
	Test 3: Concentrations of indicator constituents (As, K and Se) in all the downgradient wells are statistically increasing with time as computed using the Mann-Whitney U-test; then, evaluation of a release from the WMU will be considered and the EPA will be notified, otherwise continue quarterly groundwater monitoring as planned for the WMU.	
Specify Tolerance Limits on Decision Errors		
Tolerance Limits	Laboratory analytical methods and results will be within the accuracy specified for each parameter method as specified in the QAPP. The pH meter, water level meter, and water temperature measurements are ± 0.2 pH units, ± 0.01 ft, and ± 0.15 ° C respectively of actual value. The specific conductance measurements shall be within 0.5% or 1 umhos/cm and turbidity measurements will be within + 2% of actual value.	Groundwater pumping volume will be measured to an accuracy of 10% of the total volume pumped during each event (i.e., within 1 gallon for every 10 gallons pumped).
	In the statistical analyses the Mann-Whitney U-test is used at the level of significance of α=0.05 or 95% confidence (i.e., if the test yielded a ρ-value of less than 0.05, the null hypothesis is rejected and the two medians are considered statistically different).	
Optimize the Design for Obtaining Data		
Sample Design	The data collection design is described in the Groundwater Field Sampling Plan in Appendix A-2 of the *RCRA Pond Post-Closure Plan*	The data collection design is described in the Cap Monitoring Field Sampling Plans in Appendix A-3 of the *RCRA Pond Post-Closure Plan*

Table 1.3
RCRA POND POST CLOSURE PLAN DATA QUALITY OBJECTIVES (DQOs)
Erosion Monitoring, Benchmark Monitoring, Security Monitoring, and TMP Enclosure and Perimeter Piping Standpipe Monitoring

DQO Step	Run-On and Run-Off Erosion Monitoring	Survey Benchmarks Monitoring	Security System Monitoring	TMP Enclosure and Standpipe Monitoring
State the Problem				
Problem Statement	In order to maintain cap performance, impacts of stormwater/snowmelt or high wind events (erosion or accumulation) will be monitored on the cap surface. Stormwater collection and/or diversion systems will be inspected and maintained.	In order to maintain survey benchmarks used to determine the exact location and dimensions of the RCRA ponds and to perform the settlement monitoring, survey benchmarks will be monitored and maintained.	In order to maintain the effectiveness of the RCRA pond security systems, security system monitoring will be performed.	The TMPs (formerly used for temperature monitoring) and perimeter gas collection piping standpipes formerly used for pressure monitoring are no longer monitored for the original purpose. Nonetheless, these physical appurtenances will be maintained in a secure condition.
Relevant Deadlines	Cap surface and all stormwater/snowmelt control diversions will be monitored for erosion, sediment/debris accumulation, and/or water accumulation semiannually and within 48 hours after a triggering precipitation or high wind event, as defined in the *RCRA Pond Post-Closure Plan*.	Survey benchmarks will be inspected annually.	RCRA pond security systems will be inspected semiannually.	TMP enclosures and standpipe(s) will be inspected annually.
Identify the Decision				
Principal Study Question	Is stormwater/snowmelt runoff is being properly managed and diverted in a way that minimizes erosion and or water accumulation on the cap surface?	Are the survey benchmarks in place, accessible, and in useable condition?	Are all fences, gates, and security signs in good condition, are all gates being locked except when entry is required, are signs in place and legible, and is there any sign of unauthorized entry or tampering with security systems?	Are the TMP enclosures are intact and the lids closed and locked and perimeter pipe standpipe(s) intact and the end cap in-place and tight?
Alternative Actions	Evaluation of stormwater/runoff from the cap surface will be used to demonstrate there has been no erosion of the cap surface that would threaten cap integrity.	Inspection of survey benchmarks will be used to determine if maintenance action is required.	Inspection of security systems will be used to determine if maintenance action is required and if security systems appear to be adequate.	Inspection of TMP enclosures and standpipe(s) will be used to determine if maintenance action is required.
Identify the Decision Inputs				
Physical Inputs	Visual check for any signs of erosion, water accumulation, or sediment/debris accumulation.	Visual check to ensure benchmarks are in place, accessible and undamaged.	Visual check to ensure fences, gates, and security signs in good condition, gates being locked except when entry is required, signs in place and legible, and is there are no signs of unauthorized entry or tampering with security systems.	Visual checks to ensure TMP enclosures and standpipe(s) are intact and locked / capped / closed.
Chemical Inputs	None	None	None	None
Action Levels	Any observed erosion, water accumulation, or sediment/debris accumulation.	Any observed damage of the survey benchmarks.	Any observed damage of the fences, gates, and/or signs.	
Define the Study Boundaries				
Temporal Boundary	Cap surface and all stormwater/snowmelt control diversions will be monitored semiannually and within 48 hours after a triggering precipitation event, as defined in the *RCRA Pond Post-Closure Plan*.	Survey benchmarks will be inspected annually, in conjunction with the settlement monitoring.	Security systems will be inspected semiannually.	TMP enclosures and standpipes will be inspected annually.
Horizontal Boundary	The geographical boundaries of the cap surface and all auxiliary stormwater diversion/accumulation areas.	At the location of each survey benchmark.	At the location of RCRA pond perimeter fences, gates, and signs.	At the location of the TMP enclosures and standpipes.
Vertical Boundary	The cap surface and all auxiliary stormwater diversion/accumulation areas.	At the location of each survey benchmark.	At the location of RCRA pond perimeter fences, gates, and signs.	At the location of the TMP enclosures and standpipes.

Table 1.3 (Continued)
RCRA POST CLOSURE PLAN DATA QUALITY OBJECTIVES (DQOs)
Erosion Monitoring, Benchmark Monitoring, Security Monitoring, and TMP Enclosure and Perimeter Piping Standpipe Monitoring

DQO Step	Run-On and Run-Off Erosion Monitoring	Survey Benchmarks Monitoring	Security System Monitoring	TMP Enclosures and Standpipe Monitoring
Develop the Decision Rule				
Parameter of Interest	Not applicable.	Not applicable.	Not applicable.	Not applicable.
Decision Rule	Decision Rule a: If there is any evidence of erosion or water accumulation on the cap surface, take corrective action as soon as practicable. Proceed to Decision Rule b. Decision Rule b: If any stormwater/snowmelt diversion or accumulation structures are damaged or contain accumulations of debris/sediment, take corrective action as soon as practicable.	Decision Rule a: If there is any evidence of survey benchmark damage, tampering, or burial, take corrective action to repair/replace benchmark as soon as practicable.	Decision Rule a: If there is any evidence of fence, gate, or sign damage, tampering, or unauthorized access, take corrective action to repair/replace/improve as soon as practicable.	Decision Rule a: If there is any evidence of TMP enclosure and / or standpipe damage or missing lock or loose cap, take corrective action to repair/replace as soon as practicable.
Specify Tolerance Limits on Decision Errors				
Tolerance Limits	Not applicable.	Not applicable.	Not applicable.	Not applicable.
Optimize the Design for Obtaining Data				
Sample Design	The data collection design is described in the Cap Monitoring Field Sampling Plans in Appendix A-3 of the *RCRA Pond Post-Closure Plan.*	The data collection design is described in the Cap Monitoring Field Sampling Plans in Appendix A-3 of the *RCRA Pond Post-Closure Plan.*	The data collection design is described in the Cap Monitoring Field Sampling Plans in Appendix A-3 of the *RCRA Pond Post-Closure Plan.*	The data collection design is described in the Cap Monitoring Field Sampling Plans in Appendix A-3 of the *RCRA Pond Post-Closure Plan.*

TABLE 2.0
RCRA POND GROUNDWATER MONITORING NETWORK[1]

		RCRA POND MONITORING WELL NETWORK	
WMU NAME	**WMU NO.**	**UPGRADIENT**	**DOWNGRADIENT**
Pond 15S	3	165	113, 115, 166
Pond 8S	7	158, 183	155, 156, 157
Phase IV Ponds	8	167	104, 114, 131, 168
Pond 9E	9	124, 113	126, 127, 128
Pond 16S	10	154	147, 148, 149
Pond 8E	11	167	104, 114, 131, 168
Pond 17	14	173	171, 172, 180
Pond 18 Cell A	15	174	154, 177, 178

[1]This table presents the current RCRA groundwater monitoring network as of October 2012.

TABLE 3.1
SUMMARY OF REQUIRED LABORATORY ANALYSES FOR RCRA GROUNDWATER MONITORING

Parameter	Method Number	Method Type	Reporting Limit (mg/l)	Accuracy*	Precision**
Potassium	6010B (a)	Inductively Coupled Plasma Atomic Emission Spectrometry (ICP)	2.5	75% - 125%	± 30%
Chloride	300.0 (b) or 325.3 (c)	Ion Chromatography or Titrimetric	1	75% - 125%	± 30%
Fluoride	300.0 (b) or 340.2 (c)	Ion Chromatography or Potentiometric, Ion Selective Electrode	0.1	75% - 125%	± 30%
Arsenic	6010B (a)	ICP	0.002 (As), 0.0005 (Se)	75% - 125%	± 30%
Selenium	6010B (a)	ICP	0.002 (As), 0.0005 (Se)	75% - 125%	± 30%
Nitrate	300.0 (b) or 353.2 (d)	Ion Chromatography or Colorimetric	0.1	75% - 125%	± 35%
Total Phosphorus	6010B (a) or 365.1 (b), 365.4 (c), 4500-P (d)	ICP or Colorimetric (ascorbic acid)	0.02	75% - 125%	± 30%
Sulfate	300.0 (b) or 375.4 (d)	Ion Chromatography or Turbidimetric	1	75% - 125%	± 30%
Elemental Phosphorus (e)	7580 (b)	Gas Chromatography	0.00005	70% - 130%	± 35%
Total Ammonia (f) (NH_3 + NH_4 as N)	350.1 (b) or 350.3 (c)	Colorimetric or Potentiometric, Ion Selective Electrode	0.2	75% - 125%	± 30%

(a) Analysis may also be performed using method 6020, both 6010 and 6020 from Test Methods for Evaluating Solid Waste, EPA SW–846, Third Edition, Update IIIB or as updated.

(b) Methods for the Determination of Inorganic Substances in Environmental Samples (EPA/600/R-93/100) or as updated.

(c) Methods for Chemical Analysis of Water and Wastes, EPA600/4–79–020, Revision, March 1983 or as updated.

(d) Standard Methods for the Examination of Water and Wastewater, 20th Ed. American Public Health Association, American Water Works Association, Water Environment Federation, Approved by Standard Methods Committee, 1997 or as updated.

(e) Elemental phosphorus is analyzed semiannually at the Pond 8S well network only.

(f) The RCRA Pond wells will be sampled and analyzed for ammonia every five years during the second quarter monitoring event, beginning with the second quarter 2012 [2Q12] monitoring event.

* percent recovery

** relative percent difference

TABLE 3.2
SUMMARY OF REQUIRED FIELD ANALYSES FOR RCRA GROUNDWATER MONITORING

Field Parameter	Instrument / Method	Calibration	Estimated Accuracy*
Water Level Survey	Electrical Water Probe	Reference to Steel Tape	0.01 ft
	Steel Tape	Reference to New Tape	0.01 ft
Specific Conductance	Conductivity meter	Daily, single standard (typically 1413 µmhos/cm)	± 0.5% or 1 µmhos/cm
Dissolved Oxygen	Dissolved oxygen meter	Daily, based on local barometric pressure and water-saturated air	± 2% or 0.2 mg/L
ORP	ORP meter	Daily, using ORP buffer solution; solution temperature must also be recorded	± 20 mV
Temperature	Temperature meter	Factory calibration only	0.15 °C
Nephelometric turbidity (NTU)	Turbidity meter	Daily, check against 2 known standards	± 2%
pH	pH meter	Daily, 2- or 3-point with standard buffers (4, 7, 10)	± 0.2 pH unit

*Based on manufacturer specifications for YSI 556 MPS system and HACH 2100P turbidity meter currently used for FMC groundwater monitoring. Alternate instrumentation should have comparable estimated accuracies.

TABLE 5.0
SUMMARY OF FIELD EQUIPMENT CALIBRATION REQUIREMENTS

Field Parameter	Instrument / Method	Calibration	Calibration Frequency	Estimated Accuracy*
Water Level Survey	Electrical Water Probe	Reference to Steel Tape	Periodically	0.1 ft
	Steel Tape	Reference to New Tape	Periodically	0.01 ft
Specific Conductance	Conductivity meter	Daily, single standard (typically 1413 µmhos/cm)	Daily	± 0.5% or 1 µmhos/cm
Dissolved Oxygen	Dissolved oxygen meter	Daily, based on local barometric pressure and water-saturated air	Daily	± 2% or 0.2 mg/L
ORP	ORP meter	Daily, using ORP buffer solution; solution temperature must also be recorded	Daily	± 20 mV
Temperature	Temperature meter	Factory calibration only	Factory only	0.15 °C
Nephelometric turbidity (NTU)	Turbidity meter	Daily, check against 2 known standards	Daily	± 2%
pH	pH meter	Daily, 2- or 3-point with standard buffers (4, 7, 10)	Daily	± 0.2 pH unit

*Based on manufacturer specifications for YSI 556 MPS system and HACH 2100P turbidity meter currently used for FMC groundwater monitoring. Alternate instrumentation should have comparable estimated accuracies.

TABLE 6.0
DATABASE FIELD ACRONYMS AND DESCRIPTIONS

DATABASE FIELD NAME	Type	Size	FULL NAME	DESCRIPTION
STA_ID	Text	12	Station ID:	well number, etc. (i.e., F308300 or S308108)
AGENCY	Text	8	Agency	investigating party (EPA)
SAMP_DATE	Date/Time	8	Sample Date	date sample was taken
SAMP_ID	Text	8	Sample ID	unique identification number given to each sample
WTR_DEP	Number (Double)	8	Water Depth	depth to where water is found from casing reference notch (in ft.)
WTR_ELEV	Number (Double)	8	Water Elevation	elevation above mean sea level of groundwater (in ft.)
CHEM_NAME	Text	36	Chemical Name	name of chemical
CAS_NO	Text	12	Chemical Abstract Service Number	number that is given to identify a unique chemical by the Chemical Abstract Service
CONC_DET	Number (Double)	8	Concentration Detection	chemical concentration that was detected
QUAL	Text	4	Qualifier	laboratory qualifier given to each sample
UNITS	Text	12	Units	units of measurement
QUAL_VAL	Text	4	Validation Qualifier	qualifier assigned as a result of data validation
QUAL_CODE	Text	6	Code Qualifier	code used by validation to indicate why a qualifier was assigned
VAL_LVL	Text	4	Validation Level	level or extent of validation done
CHEM_NO	Number (Double)	8	Chemical Number	chemical number given by FMC for database sorting

TABLE 6.0
DATABASE FIELD ACRONYMS AND DESCRIPTIONS

DATABASE FIELD NAME	Type	Size	FULL NAME	DESCRIPTION
SAMP_TYPE	Text	4	Sample Type	e.g., groundwater (GW), surface water (SW) or potential source (PS) sample
LAB_NAME	Text	12	Laboratory Name	name of laboratory that performed the analyses
LAB_ID	Text	12	Laboratory Identification	identification number given to a sample by laboratory
QUAL_ANAL	Text	4	Analysis Qualifier	lab-assigned qualifier (see Qualifier Description)
QUAL_SAM	Text	8	Qualifying Sample	sample qualifier indicating that sample is not representative (see Qualifier Description)
AN_DATE	Date/Time	8	Analytical Date	date sample was analyzed for constituents
AN_METHOD	Text	20	Analytical Method	method used for analyzing chemicals
PKG_NAME	Text	9	Package Name	laboratory sample delivery group (SDG)
ACTUAL_VAL	Number (Double)	8	Actual Value	actual value shown for accuracy, used only for radiological
ACCURACY	Number (Double)	8	Accuracy	± accuracy (for rad samples)
RPT_LIM	Number (Double)	8	Reporting Limit	laboratory required reporting limit
FILE_NAME	Text	8	File Name	chronological name of an event

APPENDIX A-2

Field Sampling Plan

for

RCRA Pond Groundwater Monitoring

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1.0 INTRODUCTION

1.1 BACKGROUND

This Field Sampling Plan (FSP) provides sampling and analysis procedures for implementation of the RCRA interim status groundwater monitoring program associated with the closed RCRA ponds located at the former FMC Corporation Elemental Phosphorus Plant in Pocatello, Idaho, including the RCRA post-closure care period. The facility ceased producing elemental phosphorus from phosphate ore in December 2001. Process decommissioning and plant site dismantling activities were completed in 2006.

The FSP contains procedures for sample collection, labeling, storage, shipment, chain-of-custody protocols, and quality assurance/quality control (QA/QC). The plan also specifies the analytical parameters and test methods. Implementation of these procedures will ensure that equipment and piping that has come into contact with hazardous waste has been properly decontaminated.

1.2 PREVIOUS RESULTS

In accordance with the interim status requirements of RCRA pursuant to 40 CFR Part 265 Subpart F, groundwater monitoring wells associated with RCRA ponds, are sampled and analyzed on a quarterly basis as part of an assessment monitoring program. The results of this program are presented in annual RCRA Interim Status Groundwater Monitoring Assessment reports.

The groundwater monitoring sample results are subjected to several statistical tests to determine if hazardous waste constituents from a waste management unit have entered the groundwater. One test compares the concentrations in downgradient wells with the concentrations in upgradient wells. A second test compares the mean concentrations with mean concentrations in previous years, and a third test compares concentrations in downgradient wells with downgradient well concentrations from previous years. Based on these tests, decisions are made concerning whether or not releases from RCRA ponds have occurred.

Table 1.0 identifies each RCRA pond and the associated RCRA upgradient and downgradient monitoring wells that are sampled.

TABLE 1.0
WMU-SPECIFIC RCRA GROUNDWATER MONITORING WELLS

		Monitoring Well I.D. Numbers	
WMU No.	**RCRA Pond**	**Upgradient**	**Downgradient**
3	Pond 15S	165	113, 115 and 166
7	Pond 8S	158,183	155, 156, 157
8	Phase IV Ponds (11S, 12S, 13S, and 14S)	167	104, 114, 131, and 168
9	Pond 9E	124, 113	126, 127, and 128
10	Pond 16S	154	147, 148, and 149
11	Pond 8E	167	104, 114, 131, and 168
14	Pond 17	173	171, 172, 180
15	Pond 18 Cell A	174	154, 177, 178

2.0 Sampling Objectives

The objectives of sampling the monitoring wells associated with the WMUs (RCRA ponds) are to:

- Collect samples representative of groundwater flowing beneath the RCRA pond.
- Collect data that meets data quality objectives.
- Evaluate potential changes and/or trends in groundwater conditions beneath the RCRA pond.
- Based on groundwater evaluations, determine the status of the RCRA pond as not leaking or leaking.

To meet these objectives, data will be obtained to support several statistical tests designed to indicate whether or not the RCRA pond is leaking.

3.0 Sampling Locations and Frequency

The location of upgradient and downgradient monitoring wells for each RCRA pond is provided in Figure 1. Attachment 1 of this FSP provides a summary of the well construction details and well completion diagrams.

3.1 GROUNDWATER MONITORING WELL SAMPLES

One groundwater monitoring well sample will be collected quarterly from each of the wells for each RCRA pond listed in Table 1.0 in accordance with the procedures specified in Section 5. Each sample will then be submitted to the laboratory in accordance with the procedures specified in Section 6.

3.2 FIELD AND LABORATORY QUALITY CONTROL SAMPLES

Field and laboratory quality control (QC) samples will be prepared for each quarterly groundwater sampling event. The QC samples ensure the reliability and validity of the field collection methods and laboratory analyses conducted for each sampling event.

3.2.1 FIELD QUALITY CONTROL SAMPLES

Field QC samples are collected and analyzed to verify that sample collection and handling has not affected the quality of the groundwater samples. All field QC samples should be prepared as regular investigation samples with regard to sample volume, containers, and preservation. The following field QC samples are collected:

3.2.1.1 Field Duplicate Groundwater Monitoring Well Samples

Field duplicate groundwater samples will be collected at a frequency of one per sample delivery group or one per twenty samples collected. The well designated for a field duplicate sample will be randomly selected during each monitoring event from the RCRA program monitoring wells.

3.2.1.2 Matrix Spike / Matrix Spike Duplicate Quality Control Samples

Matrix spike / matrix spike duplicate (MS/MSD) quality control samples will also be collected at a frequency of one per sample delivery group or one per twenty samples collected. The well designated for a MS/MSD quality control sample will be randomly selected during each monitoring event from the RCRA program monitoring wells.

3.2.1.3 Field Blank Quality Control Samples

During each RCRA monitoring event, field blank samples will be collected as follows:

- *Rinsate blank* - Rinsate blanks are collected by pumping purified (distilled or deionized) water through the submersible pump setup to evaluate the effectiveness of field decontamination of sampling equipment. The blank is analyzed for the same analytical parameters as the groundwater samples. Rinsate blanks will be collected after decontamination and at a minimum frequency of one per sample delivery group or one per twenty samples collected.

- *Distilled or De-ionized water blank* – Distilled or de-ionized water blanks are aliquots of water collected directly from the field supply container and analyzed to determine distilled or de-ionized water quality. The blanks are collected at a frequency of one per sampling event in conjunction with the RCRA and Calciner Pond Remedial Action groundwater monitoring programs (i.e., one distilled or de-ionized water blank per sampling event concurrently satisfies requirement for all three monitoring programs).

EPA Region 10 may collect split samples in accordance with an EPA prepared split sampling plan.

3.2.2 LABORATORY QUALITY CONTROL SAMPLES

Laboratory QC samples consist of laboratory method blanks, laboratory control samples, matrix spike, and laboratory duplicates or matrix spike duplicates. Requirements for laboratory QC samples are specified in the *RCRA Quality Assurance Project Plan* (QAPP).

4.0 Sample Designation

All samples collected will be labeled in a clear and precise way for proper identification in the field and for tracking in the laboratory. The samples will have preassigned, identifiable, and unique numbers. At a minimum, the sample labels will contain the following information:

- Facility name.
- Sample number.
- Date of collection.
- Time of collection.
- Analytical parameter.
- Method of preservation.

Each sample will be assigned a unique sample number. The same unique number will be used to identify all containers associated with that sample. The sample coding convention used for the RCRA monitoring program (which is also consistent with FMC'S CERCLA and Calciner Pond Remedial Action groundwater programs sample coding) is described in Section 5.1.1 below.

5.0 Sampling Equipment and Procedures

This section describes the procedures to be used to collect groundwater samples. All samples will be collected in accordance with the procedures presented in this section and handled in accordance with the procedures presented in Section 6.

5.1 FIELD LOGBOOKS

Field logbooks will document where, when, how, and from whom any vital project information was obtained. Logbook entries will be complete and accurate enough to permit reconstruction of field activities. At a minimum, the following sampling information will be recorded:

- Sample location, station location, and description.
- Sample number.
- Sampler's name(s).
- Date and time of sample collection.
- Type of sample (e.g., regular, QA sample designation).
- Type of sampling equipment used.
- Onsite measurement data (e.g. temperature, pH, conductivity).
- Field observations and details important to analysis or integrity of samples (e.g., heavy rains, odors, colors).
- Type of preservation used.

In addition, the following will be kept in a Field Data Report:

- Chain-of-custody forms.
- Shipping arrangements (i.e., Federal Express air bill number).
- Recipient laboratory(ies).

5.1.1 SAMPLE CODING IN FIELD LOGBOOKS

The station location will be described in the logbook as follows, in a manner consistent with the conventions used during the remedial investigation.

A one-digit number will be used to indicate the year in which the sample was collected, for example "3" indicates a sample was collected in 2003. This digit will be followed by two others indicating the month in which the sample was collected, for example "11" indicates a sample was collected in November. Finally, additional digits or letters will identify the well from which the sample was collected. The location description, 311136, indicates a sample collected from Well 136 in November 2003.

Samples collected for field QC will be identified by a three-digit or descriptive letter combination. Numbers for well locations and field QC will be grouped as follows:

- RCRA Groundwater Monitoring Wells: 100 series numbers.
- Field Duplicate: 600 series starting with 600 for each sampling event and continuing consecutively during the event for duplicates collected.
- Rinsate: 700 series numbers starting with 700 for each sampling event and continuing consecutively during the event for rinsates collected.
- Distilled/deionized water blank: FDI.

Samples collected for laboratory QC will be identified on bottles and field paperwork using an A, B, or C designation as a suffix to the sample identifier code. These QC codes will be designated as follows:

- A - Original unspiked sample
- B - Matrix spike
- C - Matrix spike duplicate

The date of collection will be indicated in mm/dd/yy format, and the time will be indicated in accordance with the military convention. The analytical parameter and method of preservation will be indicated in unambiguous shorthand, such as K for potassium and HCl for hydrochloric acid.

Logbooks will be bound with consecutively numbered pages. Each page will be dated and the time of entry noted in military time. All entries will be legible, written in ink, and signed by the individual making the entries. Language will be factual, objective, and free of personal opinions or inappropriate terminology. In addition to the sampling information, the following specifics will also be recorded in the field logbook:

- Team members.
- Time of site arrival/entry on site and time of site departure.
- Other personnel on site.
- Any deviations from sampling plans, site safety plans, and QAPP procedures.
- Any changes in personnel and responsibilities as well as reasons for the changes.
- Equipment calibration and equipment model and serial number.

5.2 GROUNDWATER MONITORING WELL SAMPLE COLLECTION

5.2.1 WATER LEVEL MEASUREMENTS

FMC performs quarterly groundwater level (elevation) measurements at numerous monitoring wells that provide uniform coverage across the entire FMC Plant OU such that the water level measurements are coordinated among FMC's RCRA, Calciner Pond Remedial Action and interim CERCLA groundwater monitoring programs. Routine quarterly water level measurements will be taken at the following list of wells:

- Wells 101 through 191 inclusive (i.e., includes all shallow and deep wells within the FMC "100-series" wells);
- TW-5S, TW-5I, TW-5D, TW-9S, TW-11S and TW-12S; and,
- 501, 502, 503, 505, 514, 515, 516, 517, 518, 523, 524 and 525.
- In addition, the surface water elevation will be measured in the Batiste Spring channel immediately below the overflow weir from the springhouse cistern and in the Swanson Road Spring (aka the Spring at Batiste Road) basin.

Water levels will be established, generally in a single day, prior to purging and sampling the wells. Wells will be purged and sampled on subsequent days within the sampling event. An electronic sounder, accurate to the nearest (±) 0.01 feet, will be used to measure depth to water in each well. When using an electronic sounder, the probe is lowered down the casing to the top of the water column. The graduated markings on the probe wire are used to measure the depth to water from the surveyed point on the rim of the well casing. Typically, the measuring device emits a constant tone when the probe is submerged in standing water, and most electronic water level sounders have a visual indicator consisting of a small light bulb or diode that turns on when the probe encounters water. Water level sounding equipment will be decontaminated by rinsing with de-ionized or distilled water before and after use in each well.

The long-history of groundwater monitoring indicates that there is no significant sediment entering the groundwater monitoring wells. Consequently, it is unnecessary to measure total well depth on a routine basis. However, FMC's groundwater sampling contractor will measure total well depth at any wells that, based on the sampling contractors experience and historic monitoring of the wells, are suspected to have significant (e.g., above the screened interval) sediment accumulation. In the event significant sediment accumulation is found based on measured total depth compared to the well construction details for the well, the groundwater sampling contractor will notify FMC. FMC will determine whether the well will be sampled prior to or after actions to remove the excessive sediment (e.g., well redevelopment).

5.2.2 WELL PURGING

All wells will be purged prior to sampling. Three to five casing volumes of water will be purged using an electric submersible pump. Clean flexible plastic or Teflon tubes connected to pumps will be used for groundwater extraction. All tubes will be decontaminated before and after use in each well. Pumps will typically be placed approximately 10 feet below the water level in the well to permit reasonable drawdown but to prevent cascading conditions. Pumps may need to be placed lower in the water column at certain wells to avoid lowering the water level to the pump inlet horizon due to the poor yield characteristics of these monitoring wells. If necessary, purge water will be collected into a measured container to record the purge volume.

Casing volumes will be calculated based on total well depth and static water level; casing diameter will be based on the well construction details. Monitoring well construction details are summarized in Tables 2A through 2H in Attachment 1 along with water elevations measured during May 2008.
One casing volume will be calculated as:

$$V = \pi R^2 h / 19.25$$

where:

V is the volume of one well casing of water (in gallons, 1 gallon = 0.134 ft^3);

R is one-half the inner diameter of the well casing (in inches); and

h is the total depth of water in the well (in feet).

Prior to the start of sampling and after each well casing volume is purged, water temperature, pH, specific conductance, dissolved oxygen (DO) and oxidation-reduction potential (ORP) will be measured using in-line flow-through meters installed in a manifold off the pump system. A separate grab sample will be obtained to measure turbidity the same time interval as other field parameters. The flow-through cell and associated tubing will be emptied prior to sampling a subsequent well. During operation, the flow-through cell and tubing are flushed with purge water at approximately one gpm for five to ten minutes before field parameters are recorded. This flushing action and the non-absorptive nature of this sampling equipment makes it

unnecessary to otherwise decontaminate the tubing and in-line meters between uses using the equipment decontamination methods presented in Section 5.6 of this FSP. The final measurements will be recorded after these parameters have stabilized, indicating representative formation water is entering the well.

Three consecutive measurements which display consistent values of all parameters will be taken prior to sampling. Samples will be collected after three well casing volumes if parameters have stabilized. Typically, the temperature should not vary by more than (±)1°C, pH by more than 0.1 pH units, DO by no more than 0.3 mg/L and specific conductance by more than 10 percent from reading to reading. No water that has been tested with a field meter probe will be collected for chemical analysis. If these parameters have not stabilized after five casing volumes have been purged, purging will cease, a notation will be recorded in the field logbook, and samples will be collected. In accordance with Section 5.1, depth-to-water measurements, field measurements of parameters, and purge volumes will be recorded in the field logbook. The in-line flow meter used to estimate the volume of removed purged water will be field-checked for volumetric accuracy once during a sampling event by recording the time needed to obtain a known volume of purge water in a bucket.

If a monitoring well dewaters during purging and three casing volumes are not purged, that well will be allowed to recharge up to 80 percent of static water column, and dewatered once more. After water levels have recharged to 80 percent of the static water column, groundwater samples will be collected.

All field meters will be calibrated according to manufacturers' guidelines and specifications prior to beginning field work every day.

5.2.3 WELL SAMPLING

Groundwater samples will be collected from the monitoring wells specified in Table 1.0. Prior to sampling, the water level in the well will be measured as described in Section 5.2.1 and wells will be purged as described in Section 5.2.2. All wells will be sampled within 24 hours after purging. Clean nitrile gloves will be worn while collecting samples. Groundwater samples will be collected directly from the pump tubing into the appropriate sample container, preserved as described in Section 6, and chilled and processed for shipment to the laboratory. When transferring samples, care will be taken not to touch the discharge tubing to the sample container.

Section 6 gives detailed procedures for sample packaging, labeling, and shipping. All groundwater sampling equipment will be decontaminated before and after each sample is collected using procedures outlined in Section 5.6.

5.2.4 INSPECTION OF MONITORING WELL COVERS

The condition of the groundwater monitoring well covers will be observed semiannually to ensure the well covers are intact and locked. In addition, the wellhead barriers will be visually observed semiannually to ensure barriers are in place to protect the wellhead from incidental damage. Any unacceptable conditions requiring maintenance will be recorded on an inspection

form. Any maintenance shown to be necessary based on the inspection of the groundwater monitoring wells will be performed as soon as practicable and within a timeframe that will not delay the next scheduled monitoring event.

5.3 FIELD DUPLICATE QC SAMPLE COLLECTION

When collecting duplicate groundwater samples, bottles with two different sample designations will be alternated in the filling sequence. Duplicate samples will be submitted blind to the analytical laboratory.

5.4 MATRIX SPIKE / MATRIX SPIKE DUPLICATE QC SAMPLE COLLECTION

When collecting MS/MSD QC samples, a single sample designation, followed with "A," "B" and "C" suffixes for the primary, MS and MSD sample volumes respectively, will be assigned to a triple-volume sample.

5.5 FIELD BLANK QC SAMPLE COLLECTION

Rinsate blanks will be collected by pumping purified (distilled or deionized) water through the submersible pump setup after decontamination. Distilled or de-ionized water blanks will be collected directly from the field supply container.

5.6 FIELD PARAMETER MEASUREMENTS

Electrical conductivity, water temperature, turbidity and pH measurements will be made in the field during purging and immediately before collection of the water sample. Field parameter measurements are collected using an in-line flow through system as described in Section 5.2.2. A field pH meter with a combination electrode or equivalent will be used for pH measurement. A field conductivity meter will be used for specific conductance measurements. A nephelometer-type turbidimeter will be used for turbidity measurements. Temperature measurements will be performed using standard thermometers or equivalent temperature meters. A combined field meter or individual meters will be used for dissolved oxygen and ORP measurements. Combination instruments capable of measuring multiple parameters may also be used.

All instruments will be calibrated in accordance with manufacturers' recommendations. Conductivity standards and pH buffers used in the calibration will be recorded on daily calibration forms associated with each monitoring event. The field parameter measurement, calibration and accuracy requirements are summarized below on Table 2.0.

TABLE 2.0
FIELD PARAMETER MEASUREMENT, CALIBRATION AND ACCURACY REQUIREMENTS

Field Parameter	Instrument / Method	Calibration	Estimated Accuracy*
Water Level Survey	Electrical Water Probe Steel Tape	Reference to Steel Tape Reference to New Tape	0.01 ft 0.01 ft
Specific Conductance	Conductivity meter	Daily, single standard (typically 1413 µmhos/cm)	± 0.5% or 1 µmhos/cm
Dissolved Oxygen	Dissolved oxygen meter	Daily, based on local barometric pressure and water-saturated air	± 2% or 0.2 mg/L
ORP	ORP meter	Daily, using ORP buffer solution; solution temperature must also be recorded	± 20 mV
Temperature	Temperature meter	Factory calibration only	0.15 °C
Nephelometric turbidity (NTU)	Turbidity meter	Daily, check against 2 known standards	± 2%
pH	pH meter	Daily, 2- or 3-point with standard buffers (4, 7, 10)	± 0.2 pH unit

*Based on manufacturer specifications for YSI 556 MPS system and HACH 2100P turbidity meter currently used for FMC groundwater monitoring. Alternate instrumentation should have comparable estimated accuracies.

5.7 EQUIPMENT DECONTAMINATION PROCEDURE

Decontamination of sampling equipment will be consistently conducted in a manner to minimize potential cross-contamination and to ensure the quality of samples collected. The resulting decontamination fluids and residual material will be handled in the manner described in Section 7 to minimize potential recontamination of sampling equipment.

All equipment that comes into contact with potentially contaminated water will be decontaminated with the exception of the flow-through cell used to measure field parameters which is flushed with purge water prior to field parameter measurements as described in Section 5.2.2. Sampling equipment will be washed with a non-phosphate detergent scrub, followed by fresh water and de-ionized water rinses prior to each use. Equipment will be decontaminated in plastic containers, on pallets or plastic sheeting, and clean equipment will be used immediately. Clean equipment that is stored more than a few hours will be decontaminated again prior to use.

Sampling equipment will either be cleaned at the sampling location using non-phosphate detergent followed by fresh water and deionized water rinse, or will be steam-cleaned along with other equipment at a decontamination station.

Sampling equipment will be decontaminated as follows:

1. The exterior surfaces and accessible interior portions of submersible and hand pumps will be steam-cleaned or cleaned with sequential rinses of non-phosphate detergent solution, tap water, and de-ionized water prior to each use. Inaccessible interior portions of the pumps will be cleaned prior to each use by purging the same rinse water sequence through the pump and discharge lines. An effort will be made to sample the wells in the order of least to most contaminated to further minimize the risk of sample cross-contamination.

2. Bailers and tubing used for collection of the groundwater samples will be precleaned and disposed after one use or cleaned at the start of the job and between wells by steam cleaning or with a non-phosphate detergent wash followed by a tap water, and finally, a de-ionized water rinse.

3. Steel tapes, water probes, water level indicators, and transducers will be rinsed in de-ionized water or cleaned in a detergent solution and rinsed once in fresh water after each use.

4. Rinsate blanks will be collected from the submersible pump setup at the frequency specified in Section 3.2.1.3.

6.0 Sample Handling and Analysis

This section describes sample handling procedures including sample containers, sample preservation, shipping requirements and holding times, and sample analysis. These procedures are designed to ensure that samples are preserved and transported to the laboratory in a manner that is consistent and maintains sample integrity. Table 3.0 summarizes analytical parameters, sample containers, sample volume, preservatives, and holding times.

TABLE 3.0
SAMPLE HANDLING AND PRESERVATION PROCEDURES

Parameter	Recommended Container	Preservative	Maximum Holding Time
Water Quality (Cl^-, F^-, NO_3^-, SO_4^{2-})	1-liter polyethylene bottle	Cool to 4°C	6 months
Metals (As, K, Se)	2 1-liter polyethylene bottles	HNO_3 to pH<2, Cool to 4°C	6 months
Total Phosphorus	1-liter polyethylene bottle	Cool to 4°C	30 days
Elemental Phosphorus (Semiannually at Pond 8S wells only)	½-liter amber glass bottle; zero head space	Cool to 4°C	5 days for extraction
Total Ammonia (Every 5 years, beginning 2Q2012)	0.5-liter polyethylene bottle	H_2SO_4 to pH<2; Cool to 4°C	28 days

6.1 SAMPLE HANDLING

Pre-cleaned sample containers will be used for sample collection. Preservatives, if required, will be added to the containers prior to shipment of the sample containers to the laboratory.

6.2 SAMPLE SHIPMENT

All sample containers will be placed in a strong, rigid-walled shipping container such as a heavy plastic cooler. The following outlines the packaging procedures that will be followed.

1. When ice is used, secure the drain plug of the cooler with tape to prevent melting ice from leaking out of the cooler.
2. Line the cooler with bubble wrap, as needed, to prevent breakage during shipment.
3. Check screw caps for tightness and, if not full, mark the sample volume level of liquid samples on the outside of their sample bottles with indelible ink.
4. Custody-seal all container tops.

5. Affix sample labels onto the containers and write sample number on container with indelible ink.

6. Wrap all glass sample containers in bubble wrap to prevent breakage.

All samples will be placed in coolers with the appropriate chain-of-custody form. All forms will be enclosed in a large plastic bag and affixed to the underside of the cooler lid. Empty space in the cooler will be filled with bubble wrap or Styrofoam peanuts to prevent movement and breakage during shipment. Ice used to cool samples will be placed on top and around the samples to chill them to the correct temperature. Both samples and ice will be double-bagged in large plastic bags. Each ice chest will be securely taped shut with strapping tape; and custody seals will be affixed to the front and back of each cooler.

6.3 SAMPLE ANALYSIS

Required sample analyses and methods are summarized in Table 4.0.

TABLE 4.0
SUMMARY OF REQUIRED LABORATORY ANALYSES FOR RCRA GROUNDWATER MONITORING

Parameter	Method Number	Method Type	Reporting Limit (mg/l)
Potassium	6010B (a)	Inductively Coupled Plasma Atomic Emission Spectrometry (ICP)	2.5
Chloride	300.0 (b) or 325.3 (c)	Ion Chromatography or Titrimetric	1
Fluoride	300.0 (b) or 340.2 (c)	Ion Chromatography or Potentiometric, Ion Selective Electrode	0.1
Arsenic	6010B (a)	ICP	0.002 (As), 0.0005 (Se)
Selenium	6010B (a)	ICP	0.002 (As), 0.0005 (Se)
Nitrate	300.0 (b) or 353.2 (d)	Ion Chromatography or Colorimetric	0.1
Total Phosphorus	6010B (a), 365.1 (b), 365.4 (c), or 4500-P (d)	ICP or Colorimetric (ascorbic acid)	0.02
Sulfate	300.0 (b) or 375.4 (d)	Ion Chromatography or Turbidimetric	1
Elemental Phosphorus (e)	7580 (b)	Gas Chromatography	0.00005
Total Ammonia (f) (NH_3 + NH_4 as N)	350.1 (b) or 350.3 (c)	Colorimetric or Potentiometric, Ion Selective Electrode	0.2

(a) Analysis may also be performed using method 6020, both 6010 and 6020 from Test Methods for Evaluating Solid Waste, EPA SW–846, Third Edition, Update IIIB or as updated.

(b) Methods for the Determination of Inorganic Substances in Environmental Samples (EPA/600/R-93/100) or as updated.

(c) Methods for Chemical Analysis of Water and Wastes, EPA600/4–79–020, Revision, March 1983 or as updated.

(d) Standard Methods for the Examination of Water and Wastewater, 20th Ed. American Public Health Association, American Water Works Association, Water Environment Federation, Approved by Standard Methods Committee, 1997 or as updated.

(e) Elemental phosphorus is analyzed semiannually at the Pond 8S well network only.

(f) The RCRA Pond wells will be sampled and analyzed for ammonia every five years during the second quarter monitoring event, beginning with the second quarter 2012 [2Q12] monitoring event.

7.0 Disposal of Waste

In the process of collecting groundwater samples, different types of potentially contaminated wastes will be generated. The expected wastes are:

- Used personal protective equipment (PPE).
- Disposable sampling equipment.
- Decontamination fluids.
- Purged groundwater.

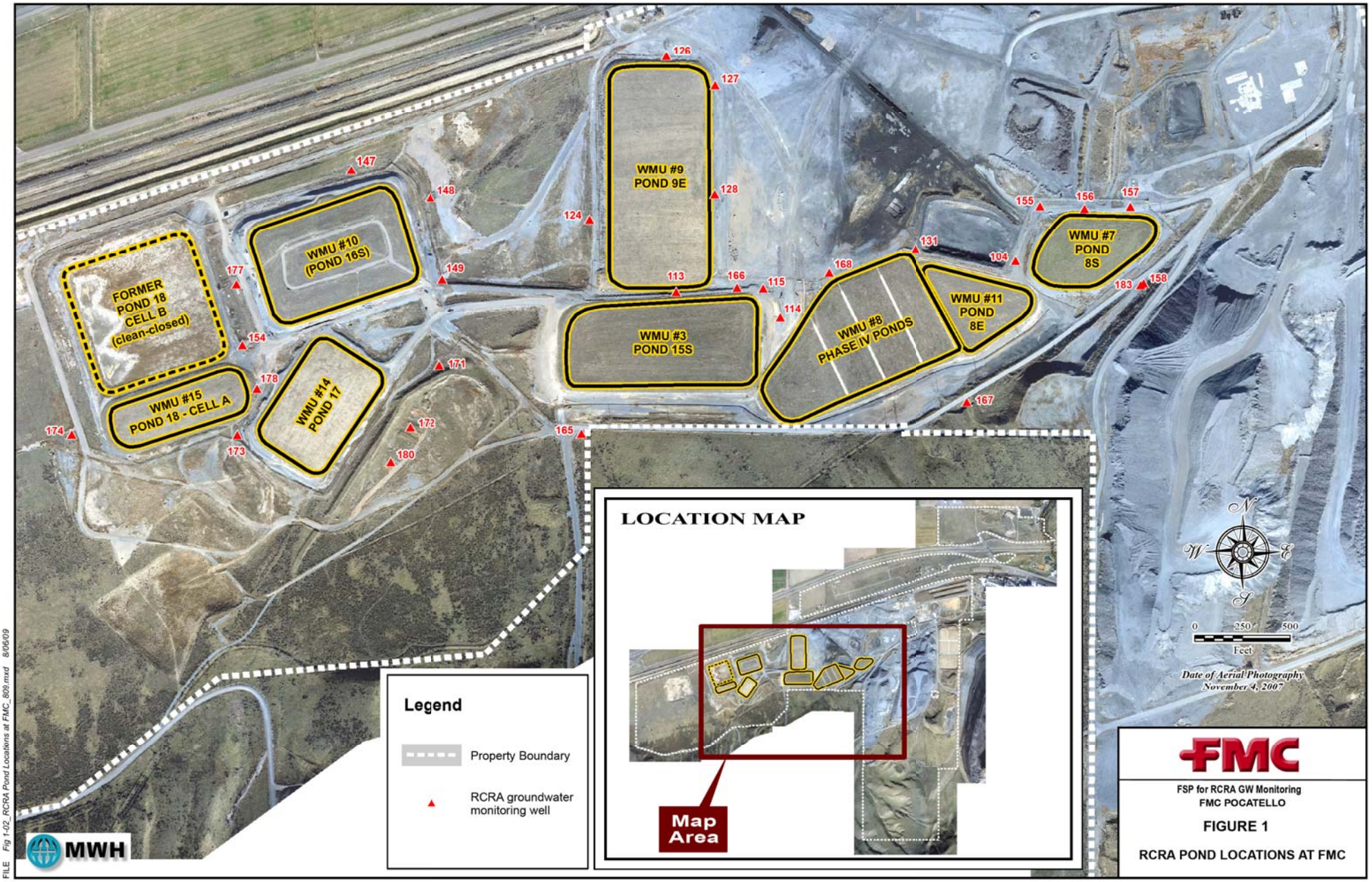
This section describes the procedures that will be followed to handle these wastes. The procedures have enough flexibility to allow the sampling team to use its professional judgment on the proper method for the disposal of each type of waste generated at each sampling location. Notwithstanding the terms and conditions of the RCRA Pond Post-Closure Plan or this Appendix A2, FMC remains subject to all applicable RCRA requirements including 40 CFR §262.11 requirements for waste determination.

7.1 USED PPE AND DISPOSABLE SAMPLING EQUIPMENT

Waste determination will be made on used PPE and disposable sampling equipment per the requirements of 40 CFR §262.11. Used PPE and disposable equipment will be bagged and accumulated in a dumpster onsite for disposal. Any PPE and disposable equipment that could be considered reusable will be rendered inoperable before disposal. If deemed to be non-hazardous, used PPE and disposable sampling equipment will be disposed in the onsite landfill or an appropriate off-site landfill. If deemed to be hazardous, used PPE and disposable sampling equipment will be disposed off-site in accordance with the generator standards of 40 CFR Part 262.

7.2 DISPOSAL OF DECONTAMINATION FLUIDS AND PURGED GROUNDWATER

Waste determination will be made on decontamination fluids and purged groundwater per the requirements of 40 CFR §262.11. Due to the low levels of contaminants in groundwater (i.e., analytical results of previous groundwater samples have not exceeded the Toxicity Criteria presented in 40 C.F.R. Part 261 Subpart C), the decontamination fluids and groundwater are presumed to be non-hazardous. If deemed to be non-hazardous, decontamination fluids and purged groundwater will be disposed onsite. If deemed to be hazardous, decontamination fluids and purged groundwater will be disposed off-site in accordance with the generator standards of 40 CFR Part 262.


FORMER POND 18 CELL B (clean-closed)
WMU #15 POND 18 - CELL A
WMU #14 POND 17
WMU #10 (POND 16S)
WMU #9 POND 9E
WMU #3 POND 15S
WMU #8 PHASE IV PONDS
WMU #11 POND 8E
WMU #7 POND 8S
126
127
128
124
147
148
149
177
154
178
171
172
180
173
174
165
113
166
115
114
168
131
104
155
156
157
183
158
167
LOCATION MAP
Map Area
Legend
Property Boundary
RCRA groundwater monitoring well
MWH
N
W
E
S
0
250
500
Feet
Date of Aerial Photography
November 4, 2007
FMC
FSP for RCRA GW Monitoring
FMC POCATELLO
FIGURE 1
RCRA POND LOCATIONS AT FMC
FILE Fig 1-02_RCRA Pond Locations at FMC_809.mxd 8/06/09

ATTACHMENT 1

WELL CONSTRUCTION SUMMARIES

AND

WELL COMPLETION DIAGRAMS

Tables 2A through 2H present a summary of well construction details. The Geologic Drill logs appear as an Appendix A in the appropriate Closure Plan.

WMU #3 (Pond 15S)

TABLE 2A
WELL CONSTRUCTION SUMMARY

Well ID	Northing	Easting	Top of Casing Elevation (FTMSL^)	Depth to Screen (ft#)	Depth to Filter Pack (ft#)	Total Depth of Well (ft#)	Total Depth Explored (ft#)	Depth to Ground-water (ft#)*	Well Dia-meter (inches)
165	449,237	551,986	4,464.2	85.0	80.7	97.0	97.2	65.17	4
113	449,982	552,482	4,463.0	82.2	77.0	94.5	97.0	64,5	4
115	450,000	552,938	4,469.7	118.5	109.0	131.0	140.0	71.62	4
166	450,004	552,802	4,467.4	85.5	82.0	98.0	99.0	69.33	4

* Determined in November 1997 and reported in RCRA Interim Status 1997 Groundwater Monitoring Assessment, February 1998.
^ Feet Above Mean Sea Level
# Feet Below Ground Surface

WMU #5 (Slag Pit Sump)

TABLE 2B
WELL CONSTRUCTION SUMMARY

Well ID	Northing	Easting	Top of Casing Elevation (FTMSL^)	Depth to Screen (ft#)	Depth to Filter Pack (ft#)	Total Depth of Well (ft#)	Total Depth Explored (ft#)	Depth to Ground-water (ft#)*	Well Diameter (inches)
121	451,767	556,106	4,485.6	106.0	96.0	118.5	120.0	89.1	4
108	452,317	556,574	4,482.4	97.6	91.0	110.1	150.0	87.3	4
122	452,470	556,282	4,475.9	101.5	90.0	113.0	121.5	80.6	4
123	452,221	557,000	4,484.1	106.5	99.0	118.5	121.2	88.8	4

* Determined in October 1997 and reported in RCRA Interim Status 1997 Groundwater Monitoring Assessment, February 1998.
^ Feet Above Mean Sea Level
# Feet Below Ground Surface

WMU #7 (Pond 8S)

TABLE 2C
WELL CONSTRUCTION SUMMARY

Well ID	Northing	Easting	Top of Casing Elevation (FTMSL^)	Depth to Screen (ft#)	Depth to Filter Pack (ft#)	Total Depth of Well (ft#)	Total Depth Explored (ft#)	Depth to Ground-water (ft#)*	Well Diam-eter (inches)
158	450,028	554,945	4,496.1	135.8	130.5	148.8	149.0	97.2	4
155	450,433	554,399	4,491.2	110.2	105.0	122.7	123.6	93.3	4
156	450,419	554,633	4,494.6	111.0	105.0	124.0	124.1	96.6	4
157	450,430	554,875	4,502.3	121.0	16.0	133.5	134.5	104.5	4
183	450,018	554,928	4,497	100.0	95.0	117.9	119.7	95.7**	4

- Determined in October 1997 and reported in RCRA Interim Status 1997 Groundwater Monitoring Assessment, February 1998.
- ** Based on well development field notes.

^ Feet Above Mean Sea Level
# Feet Below Ground Surface

WMUs #8 AND #11 (PHASE IV PONDS AND POND 8E)

TABLE 2D
WELL CONSTRUCTION SUMMARY

Well ID	**Northing**	**Easting**	**Top of Casing Elevation (FTMSL^)**	**Depth to Screen (ft#)**	**Depth to Filter Pack (ft#)**	**Total Depth of Well (ft#)**	**Total Depth Explored (ft#)**	**Depth to Ground-water (ft#)***	**Well Diameter (inches)**
104	450,146	554,270	4,487.0	96.5	88.0	109.0	110.0	87.0	4
131	450,212	553,743	4,486.2	153.9	147.0	165.6	167.0	87.3	4
114	449,849	553,030	4,470.8	116.7	112.0	129.0	141.5	71.0	4
167	449,404	554,015	4,492.6	116.5	113.5	139.0	139.0	91.4	4
168	450,082	553,286	4,474.3	75.5	71.0	93.0	93.5	74.4	4

* Determined in November 1996 and reported in RCRA Interim Status 1996 Groundwater Monitoring Assessment, February 1997.

^ Feet Above Mean Sea Level
# Feet Below Ground Surface

WMU #9 (Pond 9E)

TABLE 2E
WELL CONSTRUCTION SUMMARY

Well ID	Northing	Easting	Top of Casing Elevation (FTMSL^)	Depth to Screen (ft#)	Depth to Filter Pack (ft#)	Total Depth of Well (ft#)	Total Depth Explored (ft#)	Depth to Ground-water (ft#)*	Well Dia-meter (inches)
124	450,362	552,029	4,448.4	72.6	66.5	84.8	85.0	50.2	4
113	449,982	552,482	4,463.0	82.2	77.0	94.5	97.0	63.3	4
126	451,663	552,430	4,556.0	75.5	69.0	88.0	90.0	56.3	4
127	451,068	552,687	4,458.2	77.0	72.0	89.3	90.5	58.9	4
128	450,494	552,684	4,461.9	84.3	79.5	96.5	97.0	62.4	4

* Determined in November 1997 and reported in RCRA Interim Status 1997 Groundwater Monitoring Assessment, February 1998.
^ Feet Above Mean Sea Level
# Feet Below Ground Surface

WMU #10 (POND 16S)

TABLE 2F
WELL CONSTRUCTION SUMMARY

Well ID	Northing	Easting	Ground Elevation (FTMSL^)	Top of Casing Elevation (FTMSL^)	Depth to Screen (ft#)	Depth to Filter Pack (ft#)	Total Depth of Well (ft#)	Total Depth Explored (ft#)	Depth to Ground-water (ft#)*	Well Diam-eter (inches)
147	450,623	550,769	4,442.3	4,444.1	70.7	65.0	83.2	83.5	42.8	4
148	450,479	551,188	4,445.0	4,446.5	67.1	60.0	79.6	80.0	45.5	4
149	450,047	551,254	4,446.3	4,447.3	69.3	64.0	81.8	88.5	47.0	4
154	449,702	550,198	4,445.3	4,447.0	73.6	68.0	81.1	83	44.8	4

* Determined in October 1997 and reported in RCRA Interim Status 1997 Groundwater Monitoring Assessment, February 1998.
^ Feet Above Mean Sea Level
# Feet Below Ground Surface

WMU #14 (Pond 17)

TABLE 2G
WELL CONSTRUCTION SUMMARY

Well ID	Northing	Easting	Top of Casing Elevation (FTMSL^)	Depth to Screen (ft#)	Depth to Filter Pack (ft#)	Total Depth of Well (ft#)	Total Depth Explored (ft#)	Depth to Ground-water (ft#)*	Well Diameter (inches)
171	449,597	551,237	4,452.4	76.5	69.0	89.0	89.0	53.4	4
172[a]	449,272	551,081	4,450.6	71.0	69.0	79.0	79.5	51.5	4
173[bc]	449,231	550,172	4,452.6	70.0	65.4	87.8	89.0	50.0	4
180[a]	449,088	550,976	4,452.8	52.2	48.7	65.2	65.5	53.5	4

* Determined in August 1997, except where noted.
^ Feet Above Mean Sea Level
# Feet Below Ground Surface
a - Data for well installed in July 1997.
b - This is a replacement well near Well 179, screened in the upper coarse-grained layer of the uppermost aquifer.
c - Data for well installed in October 1998.

WMU #15 (Pond 18 Cell A)

TABLE 2H
WELL CONSTRUCTION SUMMARY

Well ID	Northing	Easting	Top of Casing Elevation (FTMSL^)	Depth to Screen (ft#)	Depth to Filter Pack (ft#)	Total Depth of Well (ft#)	Total Depth Explored (ft#)	Depth to Ground-water (ft#)*	Well Diameter (inches)
154[a]	449,702	550,198	4,447	73.6	68.0	81.1	83.0	50.0	4
174	449,233	549,303	4,446.9	75.0	70.1	87.9	88.0	50.0	4
177	450,022	550,106	4,444.6	75.1	71.4	88.0	88.4	50.0	4
178	449,474	550,275	4,451.1	60.0	56.4	77.8	78.5	46.5	4

* Determined in October 1998, except where noted.
^ Feet Above Mean Sea Level
# Feet Below Ground Surface
a - Data for well installed in November 1992.

WMU # 3 (POND 15S)

WELL COMPLETION DIAGRAMS

MONITORING WELL

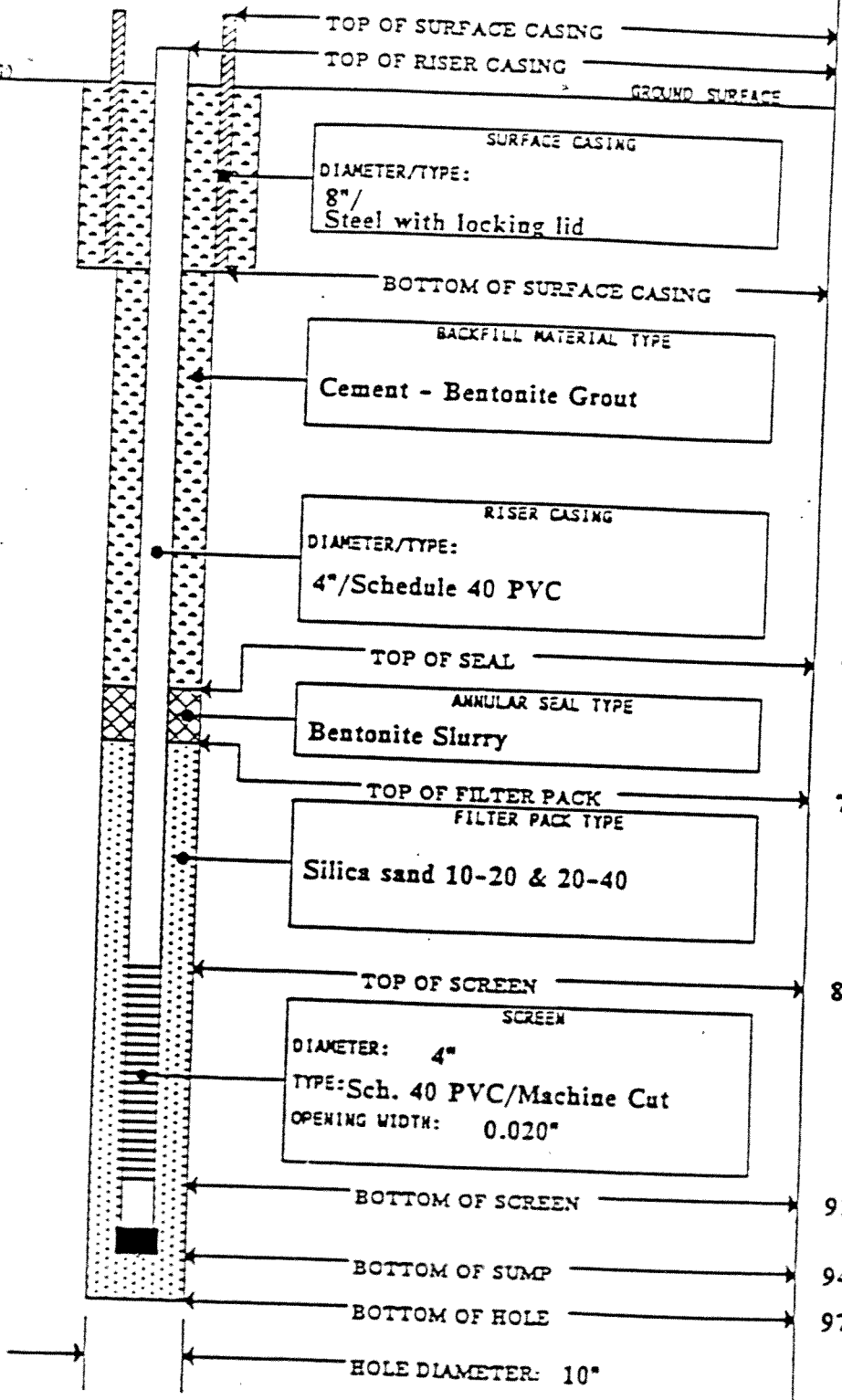
JOB NO.	SITE	PROJECT	WELL NO.
21372	North of Pond 15S	EMF POCATELLO, ID	113

BEGUN	COMPLETED	PREPARED BY	COORDINATES and/or STATIONINGS	REFERENCE POINT FOR MEASUREMENTS
10-15-90	10-16-90	Garrett Day	N 449,982.1 E 552,482.1	Top of PVC casing(Water level)

(GENERALIZED GEOLOGIC LOG)

See Boring Logs.

NOT TO SCALE



	DEPTH (FT)	ELEV. (FTMSL)
TOP OF SURFACE CASING	2.1	4463.3
TOP OF RISER CASING	1.8	4463.0
GROUND SURFACE	0.0	4461.2
BOTTOM OF SURFACE CASING	2.9	4458.2
TOP OF SEAL	73.0	4388.2
TOP OF FILTER PACK	77.0	4384.2
TOP OF SCREEN	82.2	4379.0
BOTTOM OF SCREEN	91.7	4369.5
BOTTOM OF SUMP	94.5	4366.7
BOTTOM OF HOLE	97.0	4364.2

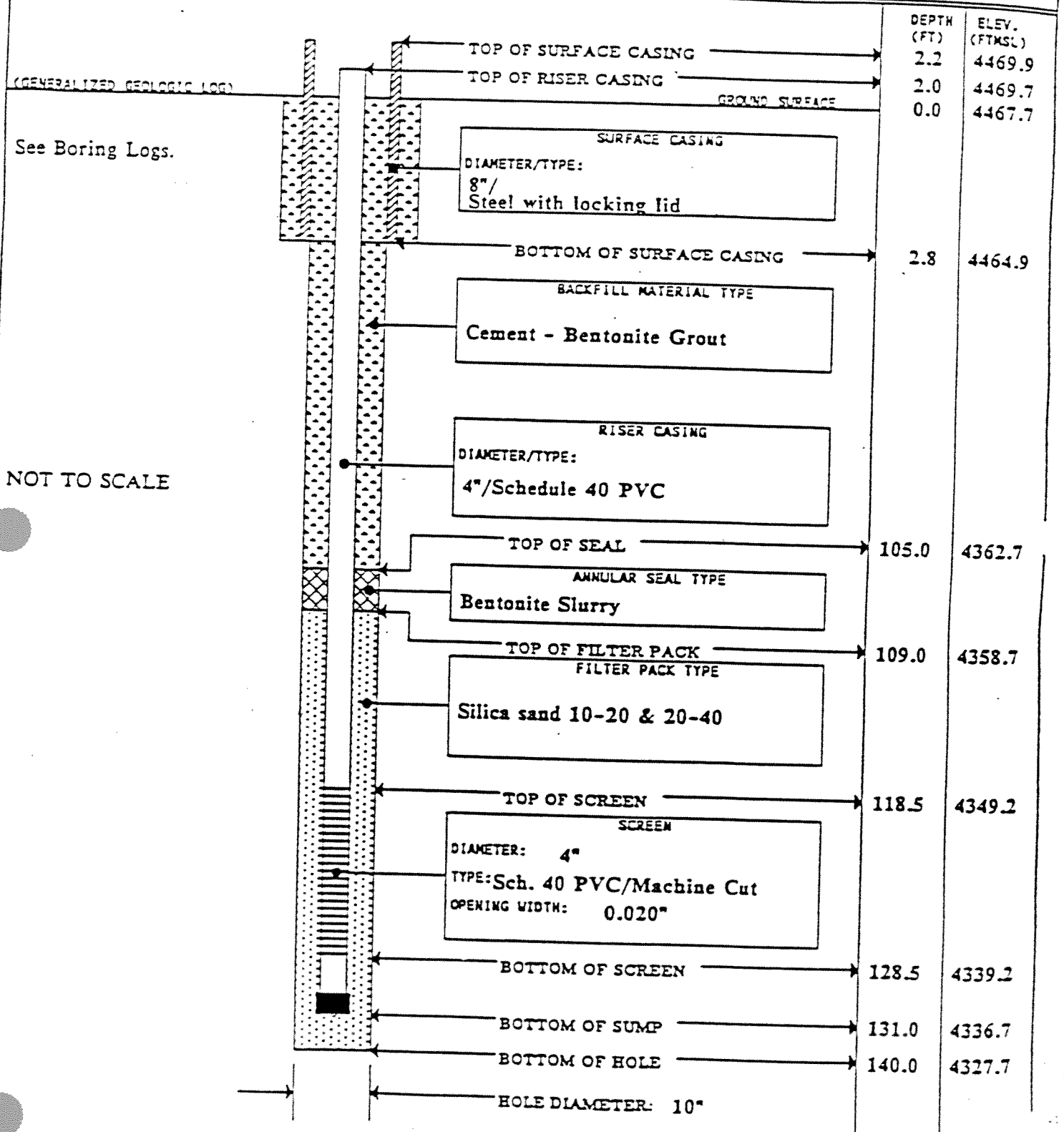
Update: 8-12-92
Template: ZWELLOG

NOT TO SCALE

MONITORING WELL

JOB NO.	SITE	PROJECT	WELL NO.
21372	Northeast of Pond 15S	EMF POCATELLO, ID	115

BEGUN	COMPLETED	PREPARED BY	COORDINATES and/or STATIONINGS	REFERENCE POINT FOR MEASUREMENTS
9-15-90	10-15-90	Curtis Obi	N 449,999.6 E 552,938.2	Top of PVC casing(Water level)



	DEPTH (FT)	ELEV. (FTMSL)
TOP OF SURFACE CASING	2.2	4469.9
TOP OF RISER CASING	2.0	4469.7
GROUND SURFACE	0.0	4467.7
BOTTOM OF SURFACE CASING	2.8	4464.9
TOP OF SEAL	105.0	4362.7
TOP OF FILTER PACK	109.0	4358.7
TOP OF SCREEN	118.5	4349.2
BOTTOM OF SCREEN	128.5	4339.2
BOTTOM OF SUMP	131.0	4336.7
BOTTOM OF HOLE	140.0	4327.7

Update: 8-12-92
Template: ZWELLOG

NOT TO SCALE

MONITORING WELL

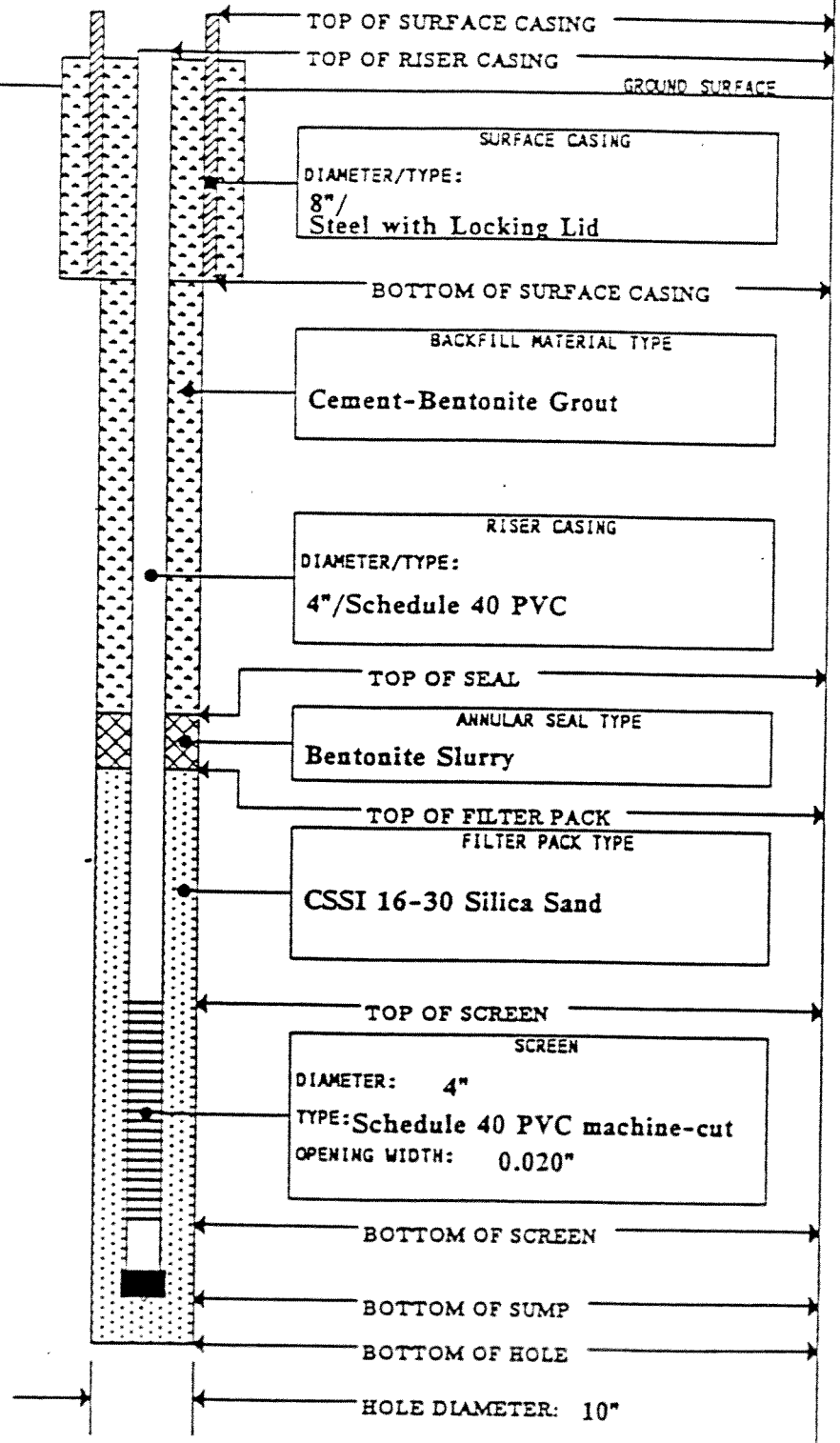
PROJECT	WELL NO.
EMF POCATELLO, ID	165

JOB NO.	SITE	COORDINATES and/or STATIONING
21372	FMC Corporation	N 449,237 E 551,986

BEGUN	COMPLETED	PREPARED BY	REFERENCE POINT FOR MEASUREMENTS
8-25-95	8-25-95	Curtis Obi	Top of PVC Casing-Water Levels

(GENERALIZED GEOLOGIC LOG)

See Geologic Drill Log for Details.



	DEPTH (FT)	ELEV. (FTMSL)
TOP OF SURFACE CASING	2.9	4464.6
TOP OF RISER CASING	2.5	4464.2
GROUND SURFACE	0.0	4461.7
BOTTOM OF SURFACE CASING	2.1	4459.6
TOP OF SEAL	70.7	4391.0
TOP OF FILTER PACK	80.7	4381.0
TOP OF SCREEN	85.0	4376.7
BOTTOM OF SCREEN	95.0	4366.7
BOTTOM OF SUMP	97.0	4364.7
BOTTOM OF HOLE	97.2	4364.5

Update: 10-19-95
Template: 2WELLOG

NOT TO SCALE

MONITORING WELL

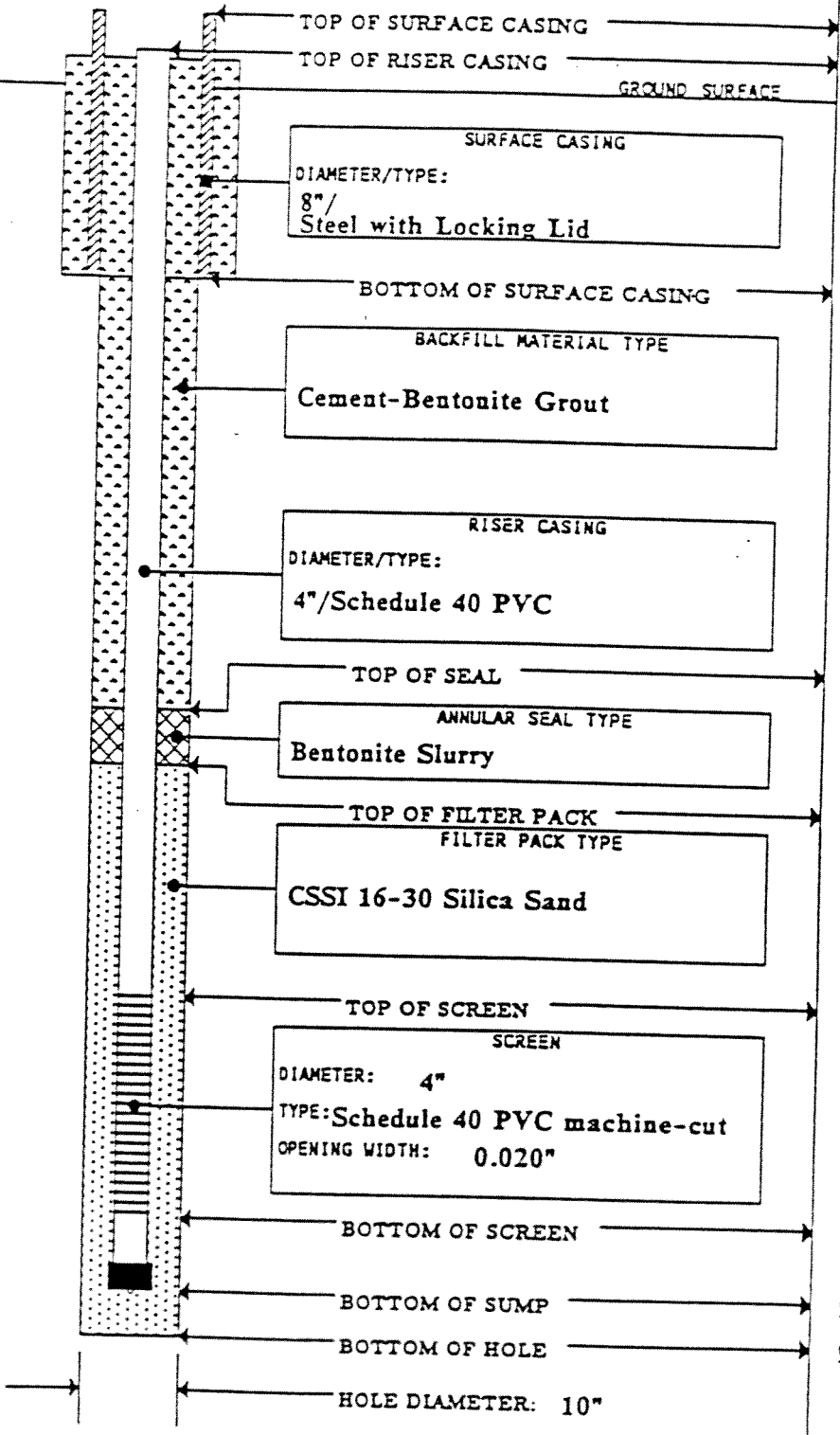
JOB NO.	SITE	PROJECT	WELL NO.
21372	FMC Corporation	EMF POCATELLO, ID	166

COORDINATES and/or STATIONING	
N 450,004 E 552,802	

BEGUN	COMPLETED	PREPARED BY	REFERENCE POINT FOR MEASUREMENTS
8-27-95	8-27-95	Curtis Obi	Top of PVC Casing-Water Levels

(GENERALIZED GEOLOGIC LOG)

See Geologic Drill Log for Details.



	DEPTH (FT)	ELEV. (FTMSL)
TOP OF SURFACE CASING	2.7	4468.1
TOP OF RISER CASING	2.0	4467.4
GROUND SURFACE	0.0	4465.4
BOTTOM OF SURFACE CASING	2.3	4463.1
TOP OF SEAL	72.0	4393.4
TOP OF FILTER PACK	82.0	4383.4
TOP OF SCREEN	85.5	4379.9
BOTTOM OF SCREEN	95.5	4369.9
BOTTOM OF SUMP	98.0	4367.4
BOTTOM OF HOLE	99.0	4366.4

Update: 10-19-95
Template: 2WELLOG

NOT TO SCALE

WMU # 5 (SLAG PIT SUMP)

WELL COMPLETION DIAGRAMS

MONITORING WELL

PROJECT	WELL NO.
EMF POCATELLO, ID	108

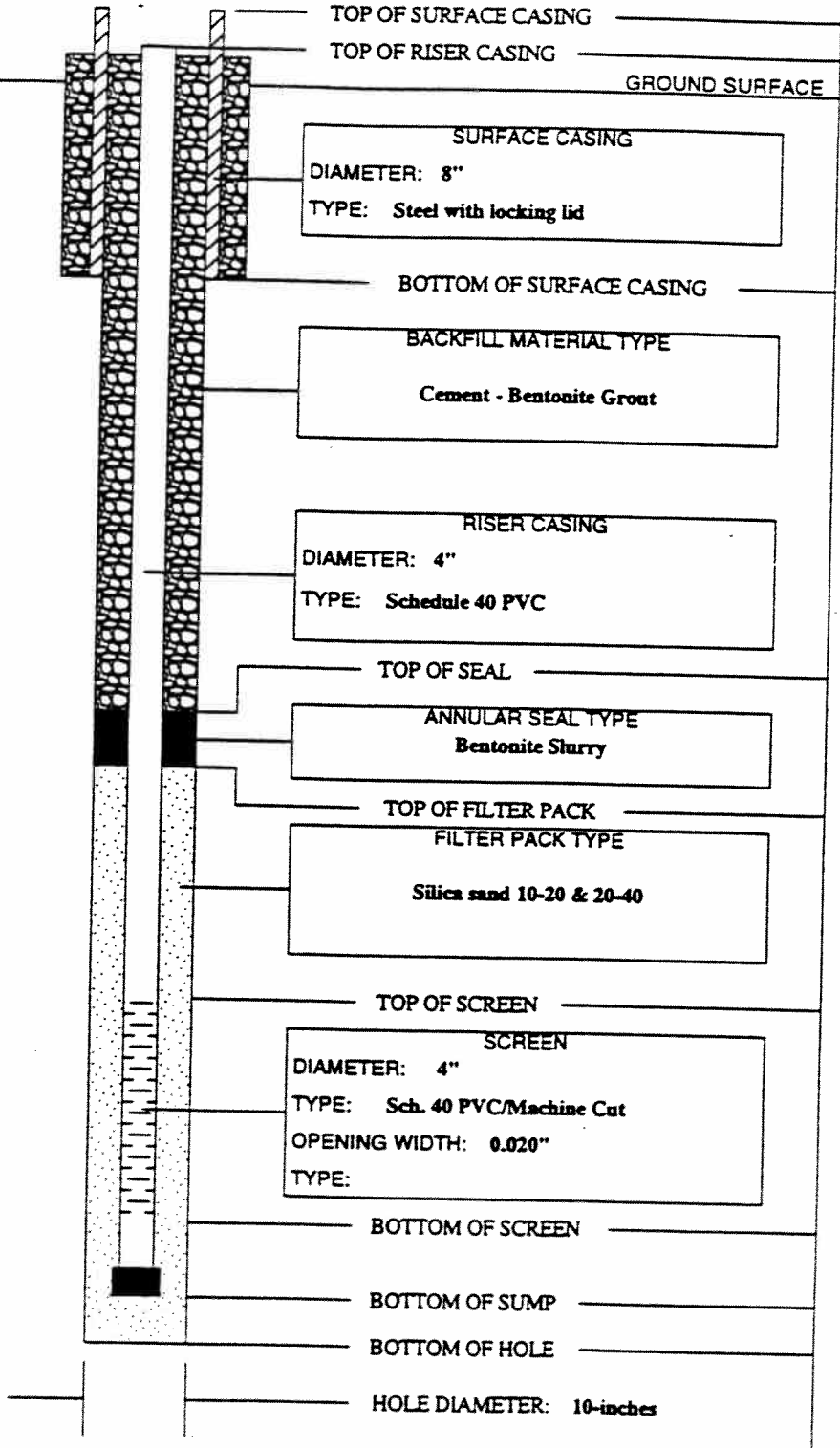
JOB NO.	SITE	COORDINATES and / or STATIONING
20906	Northeast of Slag Pit Sump	N 452,316.5 : E 556,573.7

BEGUN	COMPLETED	PREPARED BY	REFERENCE POINT FOR MEASUREMENTS
10-12-90	10-12-90	Curtis Obi	Top of PVC casing (water level)

(GENERALIZED GEOLOGIC LOG)

See Boring Logs.

NOT TO SCALE



	DEPTH (FT)	ELEV. (FTMSL)
TOP OF SURFACE CASING	-2.3	4482.55
TOP OF RISER CASING	-2.1	4482.4
GROUND SURFACE	0.0	4480.3
BOTTOM OF SURFACE CASING	2.7	4477.6
TOP OF SEAL	87.0	4393.3
TOP OF FILTER PACK	91.0	4389.3
TOP OF SCREEN	97.6	4382.7
BOTTOM OF SCREEN	107.6	4372.7
BOTTOM OF SUMP	110.1	4370.2
BOTTOM OF HOLE	150.0	4330.3

Update: Apr 22, 1998

Report Form: EMF-WELLOG2

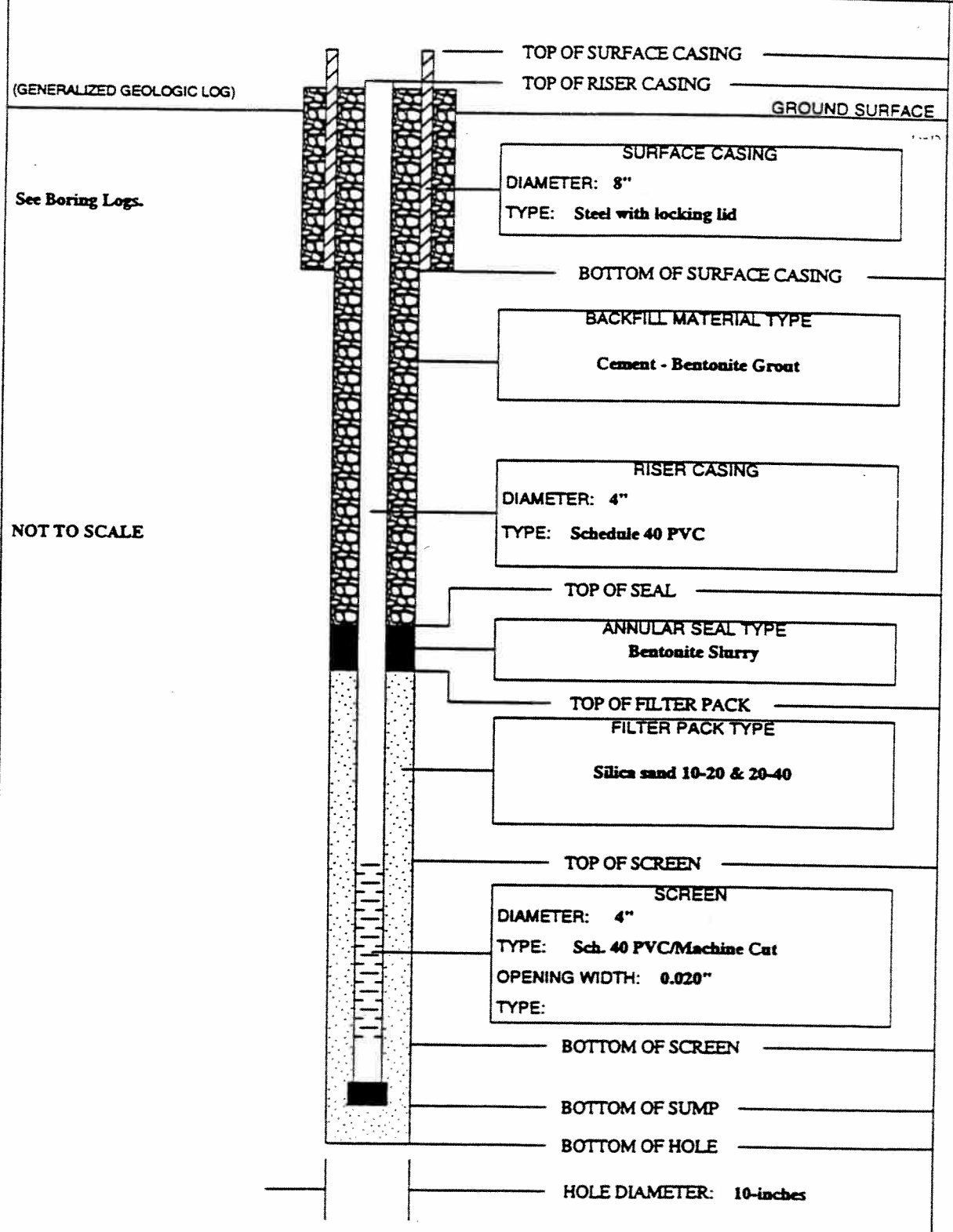
NOT TO SCALE

MONITORING WELL

PROJECT	WELL NO.
EMF POCATELLO, ID	121

JOB NO.	SITE	COORDINATES and / or STATIONING
20906	Southwest of Slag Pit Sump	N 451,766.8 : E 556,105.7

BEGUN	COMPLETED	PREPARED BY	REFERENCE POINT FOR MEASUREMENTS
10-10-90	10-10-90	Curtis Obi	Top of PVC casing (water level)



	DEPTH (FT)	ELEV. (FTMSL)
TOP OF SURFACE CASING	-2.3	4485.76
TOP OF RISER CASING	-2.1	4485.58
GROUND SURFACE	0.0	4483.5
BOTTOM OF SURFACE CASING	2.7	4480.8
TOP OF SEAL	92.0	4391.5
TOP OF FILTER PACK	96.0	4387.5
TOP OF SCREEN	106.0	4377.5
BOTTOM OF SCREEN	116.0	4367.5
BOTTOM OF SUMP	118.5	4365.0
BOTTOM OF HOLE	120.0	4363.5

NOT TO SCALE

MONITORING WELL

PROJECT	WELL NO.
EMF POCATELLO, ID	122

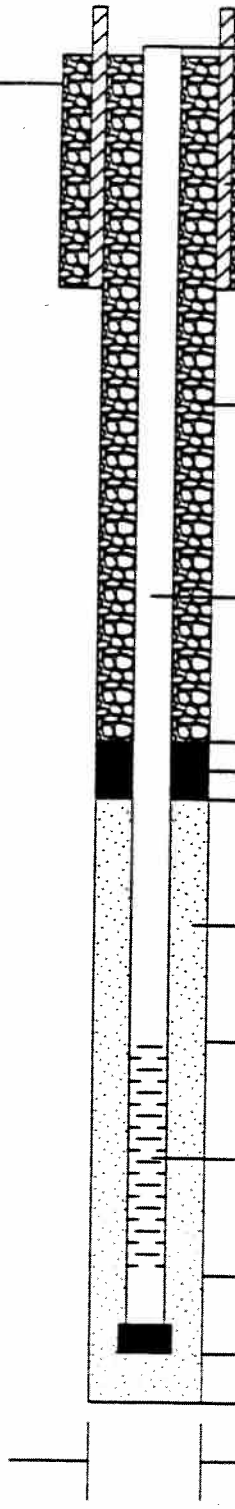
JOB NO.	SITE	COORDINATES and / or STATIONING
20906	North of Slag Pit Sump	N 452,470.2 : E 556,282.4

BEGUN	COMPLETED	PREPARED BY	REFERENCE POINT FOR MEASUREMENTS
10-11-90	10-11-90	Curtis Obi	Top of PVC casing (water level)

(GENERALIZED GEOLOGIC LOG)

See Boring Logs.

NOT TO SCALE



	DEPTH (FT)	ELEV. (FTMSL)
TOP OF SURFACE CASING	-2.2	4476.1
TOP OF RISER CASING	-2.0	4475.92
GROUND SURFACE	0.0	4473.9
SURFACE CASING DIAMETER: 8" TYPE: Steel with locking lid		
BOTTOM OF SURFACE CASING	2.8	4471.1
BACKFILL MATERIAL TYPE Cement - Bentonite Grout		
RISER CASING DIAMETER: 4" TYPE: Schedule 40 PVC		
TOP OF SEAL	86.0	4387.9
ANNULAR SEAL TYPE Bentonite Slurry		
TOP OF FILTER PACK	90.0	4383.9
FILTER PACK TYPE Silica sand 10-20 & 20-40		
TOP OF SCREEN	101.5	4372.4
SCREEN DIAMETER: 4" TYPE: Sch. 40 PVC/Machine Cut OPENING WIDTH: 0.020" TYPE:		
BOTTOM OF SCREEN	111.5	4362.4
BOTTOM OF SUMP	113.0	4360.9
BOTTOM OF HOLE	121.5	4352.4
HOLE DIAMETER: 10-inches		

Update: Apr 22, 1998

Report Form: EMF-WELLOG2

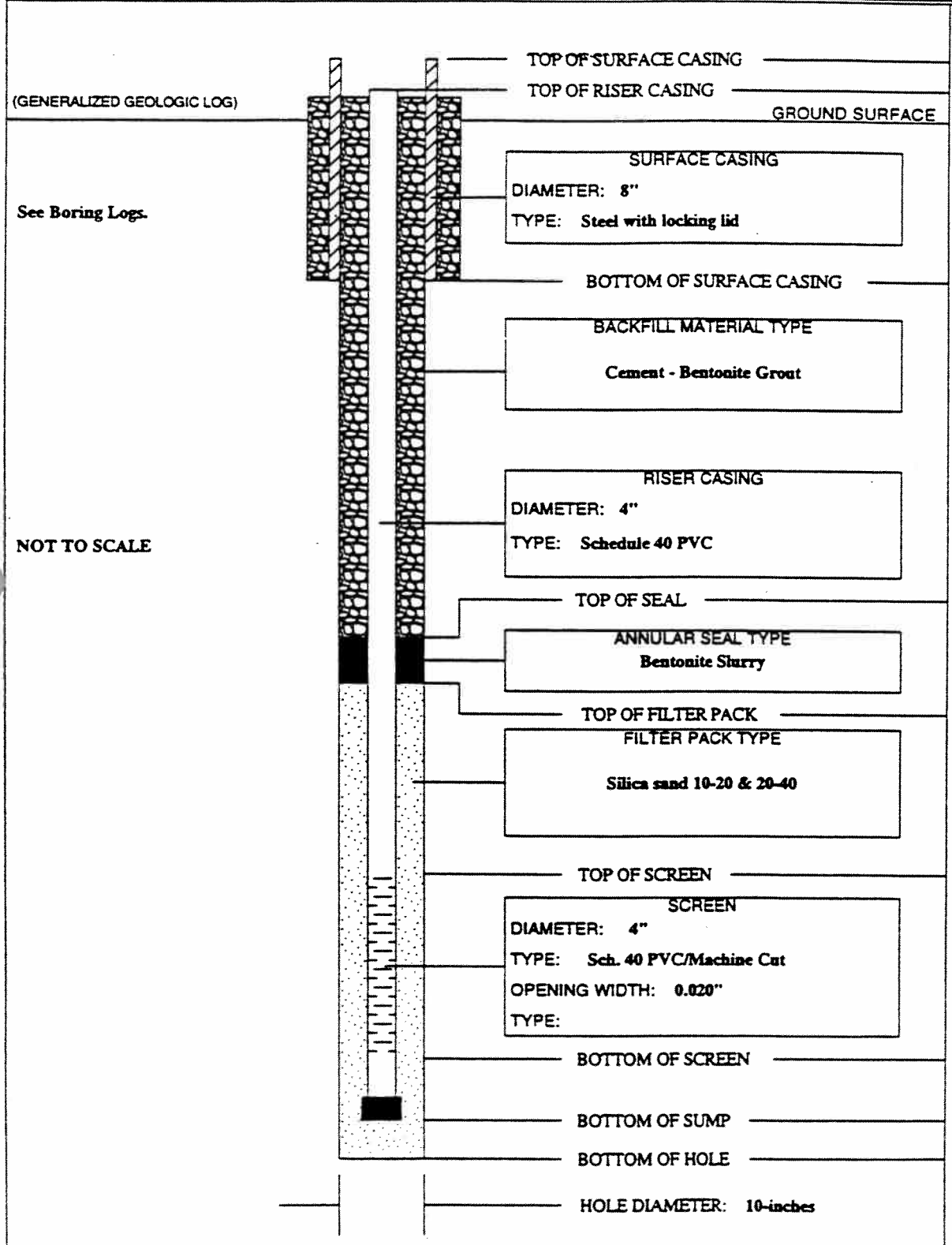
NOT TO SCALE

MONITORING WELL

PROJECT	WELL NO.
EMF POCATELLO, ID	123

JOB NO.	SITE	COORDINATES and / or STATIONING
20906	Northeast of Slag Pit Sump	N 452,221.3 : E 557,000.1

BEGUN	COMPLETED	PREPARED BY	REFERENCE POINT FOR MEASUREMENTS
10-13-90	10-13-90	Curtis Obi	Top of PVC casing (water level)



	DEPTH (FT)	ELEV. (FTMSL)
TOP OF SURFACE CASING	-2.3	4484.29
TOP OF RISER CASING	-2.1	4484.12
GROUND SURFACE	0.0	4482.0
BOTTOM OF SURFACE CASING	2.7	4479.3
TOP OF SEAL	95.0	4387.0
TOP OF FILTER PACK	99.0	4383.0
TOP OF SCREEN	106.5	4375.5
BOTTOM OF SCREEN	116.0	4366.0
BOTTOM OF SUMP	118.5	4363.5
BOTTOM OF HOLE	121.2	4360.8

WMU # 7 (POND 8S)

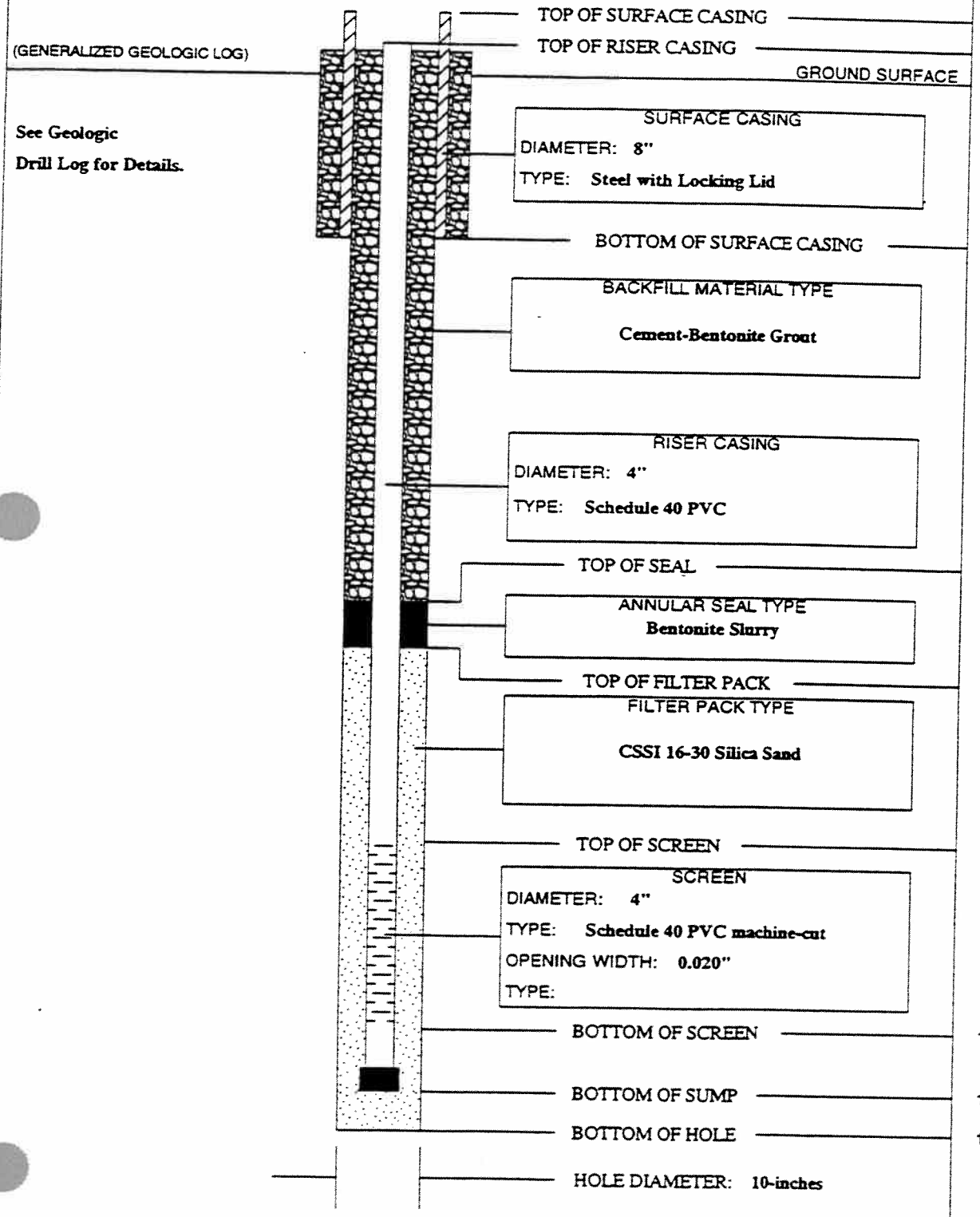
WELL COMPLETION DIAGRAMS

MONITORING WELL

PROJECT	WELL NO.
EMF POCATELLO, ID	155

JOB NO.	SITE	COORDINATES and / or STATIONING
9906	FMC Corporation	N 450,432.7 : E 554,398.5

JN	COMPLETED	PREPARED BY	REFERENCE POINT FOR MEASUREMENTS
9-6-95	9-6-95	Curtis Obi	Top of PVC Casing-Water Levels



	DEPTH (FT)	ELEV. (FTMSL)
TOP OF SURFACE CASING	-3.1	4492.1
TOP OF RISER CASING	-2.2	4491.21
GROUND SURFACE	0.0	4489.0
BOTTOM OF SURFACE CASING	1.9	4487.1
TOP OF SEAL	95.0	4394.0
TOP OF FILTER PACK	105.0	4384.0
TOP OF SCREEN	110.2	4378.8
BOTTOM OF SCREEN	120.2	4368.8
BOTTOM OF SUMP	122.7	4366.3
BOTTOM OF HOLE	123.6	4365.4

NOT TO SCALE

Update: Oct 13, 1997
Report Form: EMF-WELLOG2

MONITORING WELL

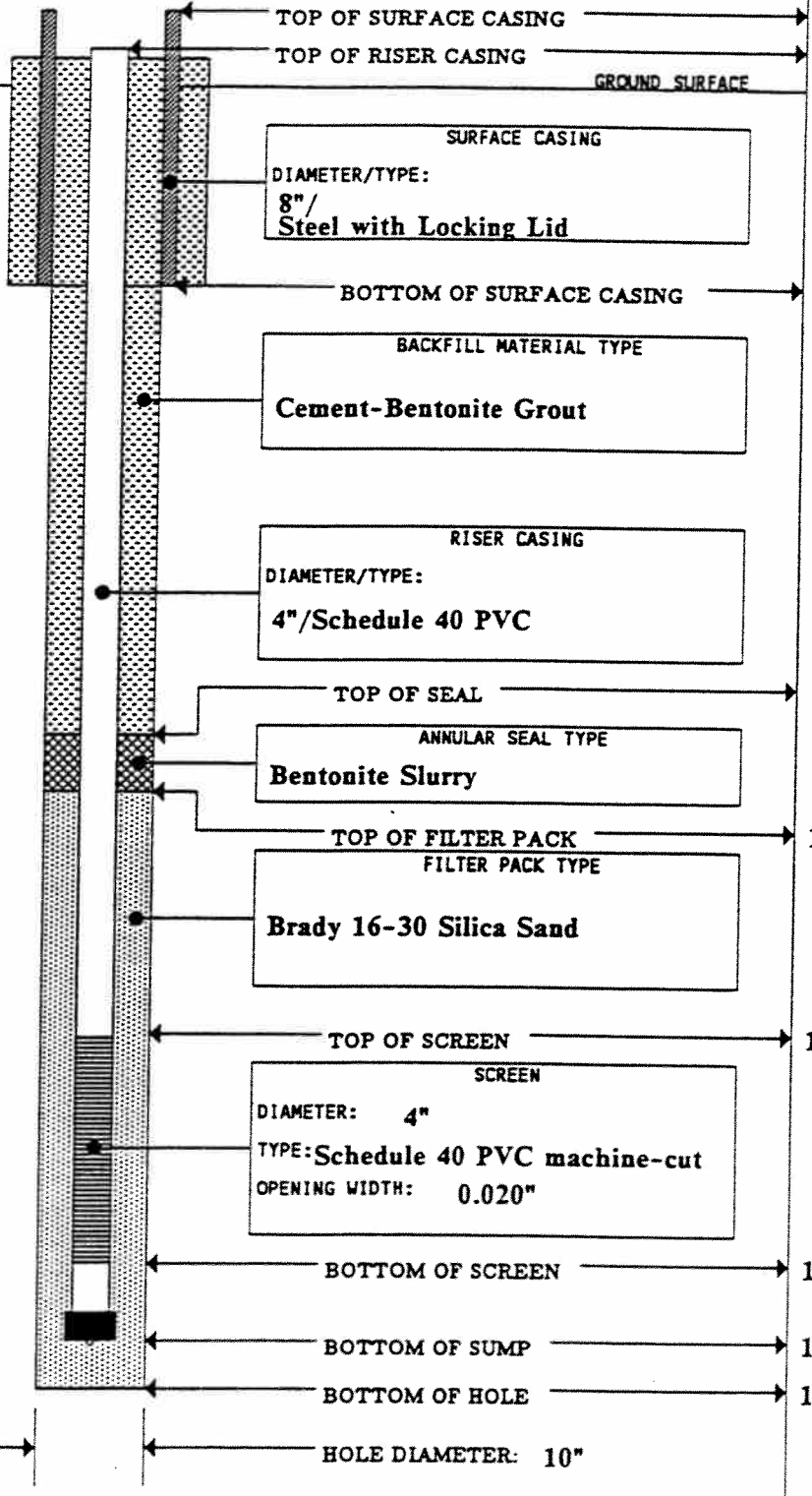
PROJECT	WELL NO.
EMF POCATELLO, ID	156

JOB NO.	SITE	COORDINATES and/or STATIONING
21372	FMC Corporation	N 450,419 E 554,633

BEGUN	COMPLETED	PREPARED BY	REFERENCE POINT FOR MEASUREMENTS
9-9-95	9-9-95	Curtis Obi	Top of PVC Casing-Water Levels

(GENERALIZED GEOLOGIC LOG)

See Geologic Drill Log for Details.



	DEPTH (FT)	ELEV. (FTMSL)
TOP OF SURFACE CASING	2.9	4495.0
TOP OF RISER CASING	2.5	4494.6
GROUND SURFACE	0.0	4492.1
BOTTOM OF SURFACE CASING	2.1	4490.0
TOP OF SEAL	95.0	4397.1
TOP OF FILTER PACK	105.0	4387.1
TOP OF SCREEN	111.0	4381.1
BOTTOM OF SCREEN	121.0	4371.1
BOTTOM OF SUMP	124.0	4368.1
BOTTOM OF HOLE	124.1	4368.0

NOT TO SCALE

Update: 10-19-95
Template: 2WELLOG

MONITORING WELL

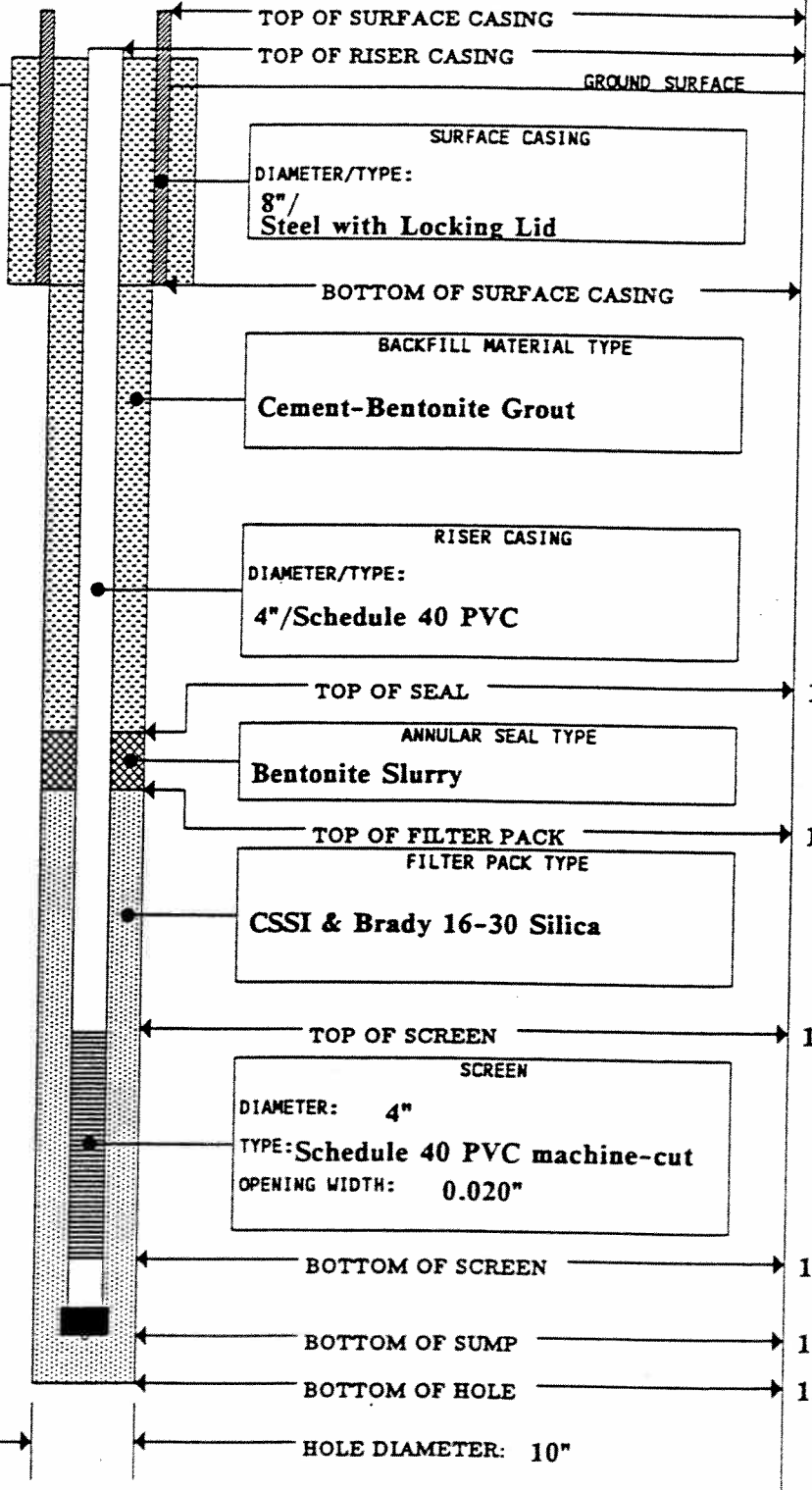
PROJECT	WELL NO.
EMF POCATELLO, ID	157

JOB NO.	SITE	COORDINATES and/or STATIONING
21372	FMC Corporation	N 450,430 E 554,874

BEGUN	COMPLETED	PREPARED BY	REFERENCE POINT FOR MEASUREMENTS
9-7-95	9-8-95	Curtis Obi	Top of PVC Casing-Water Levels

(GENERALIZED GEOLOGIC LOG)

See Geologic Drill Log for Details.



	DEPTH (FT)	ELEV. (FTMSL)
TOP OF SURFACE CASING	2.8	4503.0
TOP OF RISER CASING	2.1	4502.3
GROUND SURFACE	0.0	4500.2
BOTTOM OF SURFACE CASING	2.2	4498.0
TOP OF SEAL	106.0	4394.2
TOP OF FILTER PACK	116.0	4384.2
TOP OF SCREEN	121.0	4379.2
BOTTOM OF SCREEN	131.0	4369.2
BOTTOM OF SUMP	133.5	4366.7
BOTTOM OF HOLE	134.5	4365.7

NOT TO SCALE

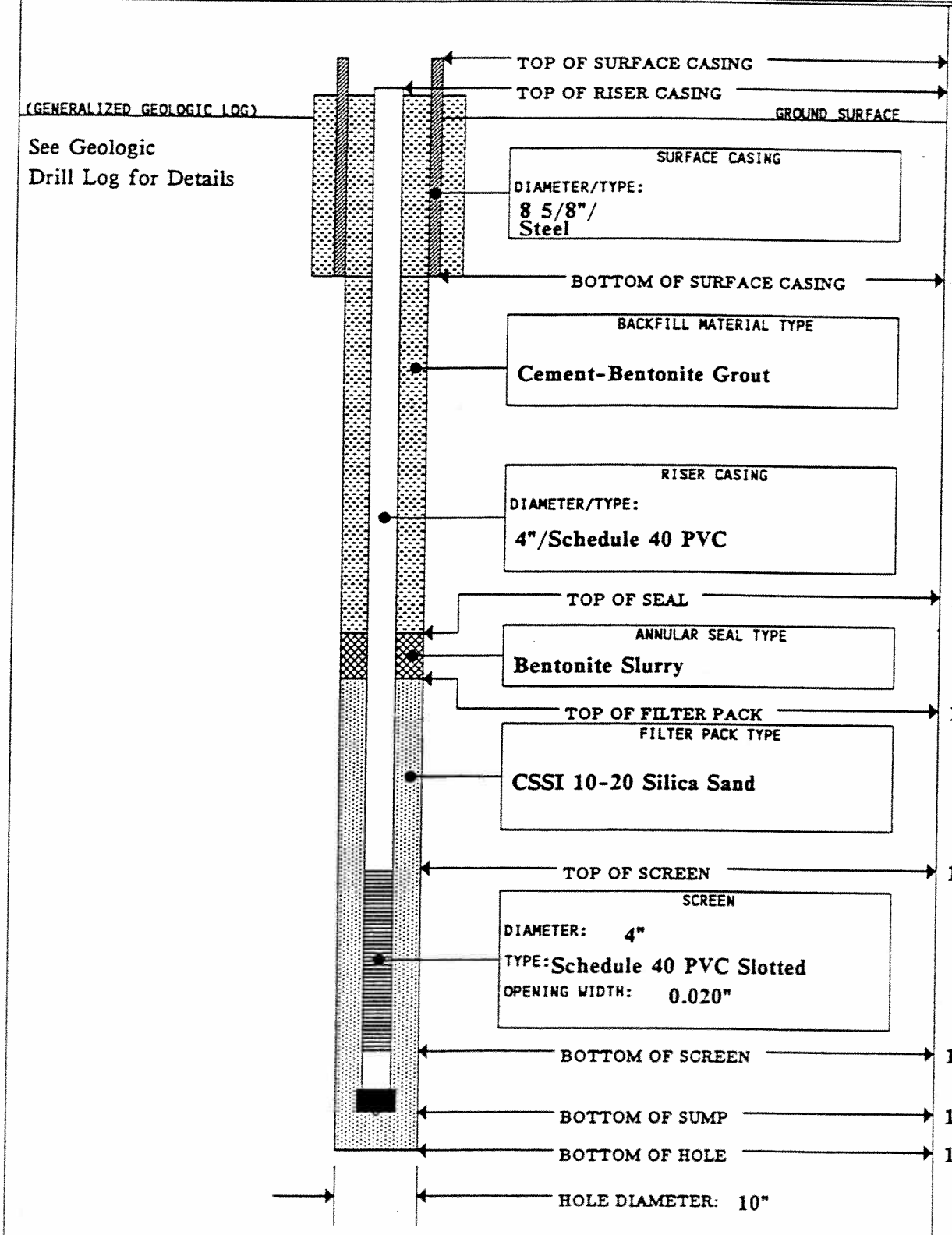
Update: 10-19-95
Template: 2WELLOG

MONITORING WELL

PROJECT	WELL NO.
EMF POCATELLO, ID	158

JOB NO.	SITE	COORDINATES and/or STATIONING
21372	FMC Corporation	N 450,028 E 554,945

BEGUN	COMPLETED	PREPARED BY	REFERENCE POINT FOR MEASUREMENTS
6-23-93	6-24-93	Dave Kyllonen	Top of PVC - Water levels



	DEPTH (FT)	ELEV. (FTMSL)
TOP OF SURFACE CASING	2.9	4496.9
TOP OF RISER CASING	2.1	4496.1
GROUND SURFACE	0.0	4494.0
BOTTOM OF SURFACE CASING	2.1	4491.9
TOP OF SEAL	120.0	4374.0
TOP OF FILTER PACK	130.5	4363.5
TOP OF SCREEN	135.8	4358.2
BOTTOM OF SCREEN	145.8	4348.2
BOTTOM OF SUMP	148.8	4345.2
BOTTOM OF HOLE	149.0	4345.0

Update: 9-8-93
Template: 2WELLOG

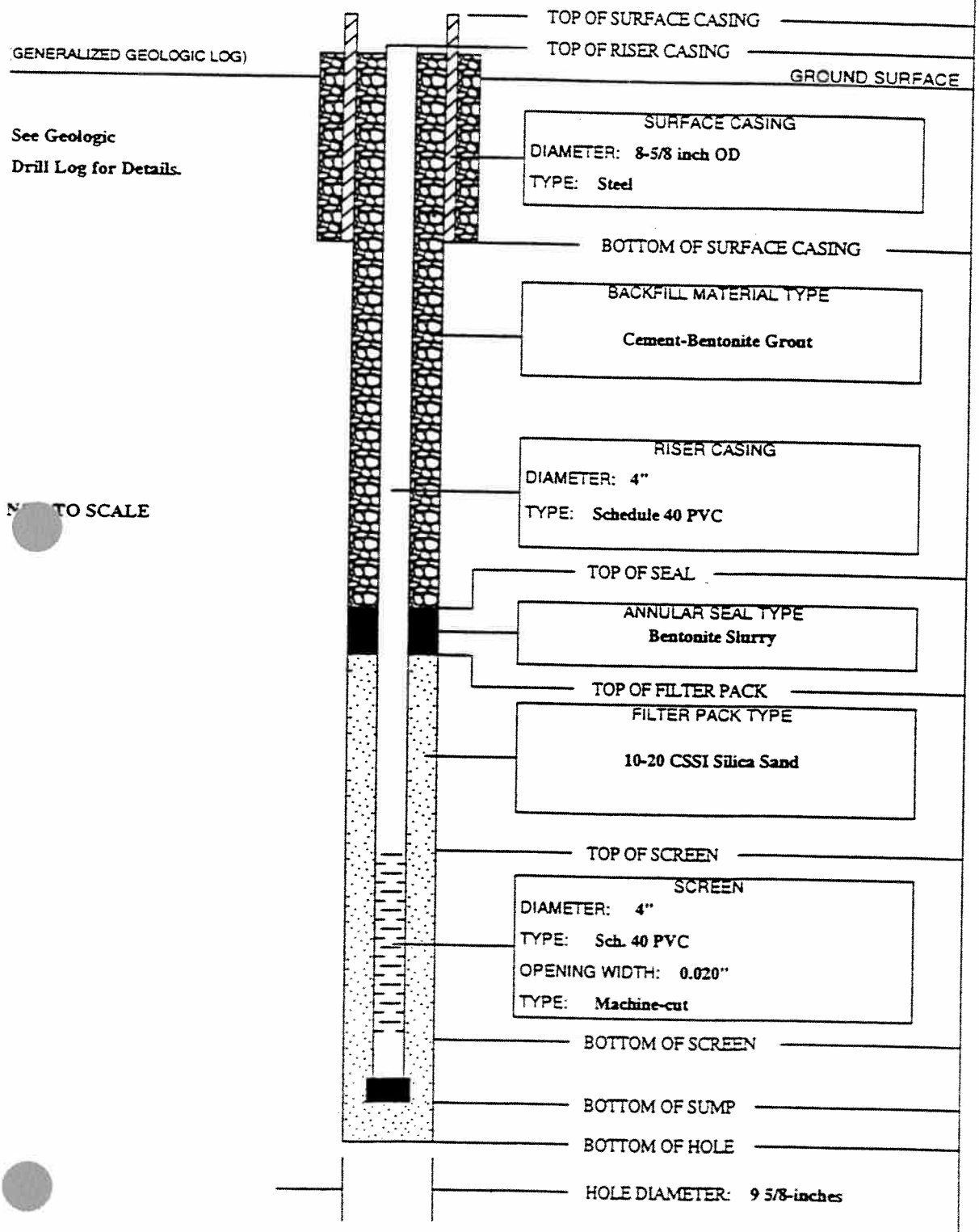
NOT TO SCALE

MONITORING WELL

PROJECT	WELL NO.
EMF POCATELLO, ID	183

OB NO.	SITE	COORDINATES and / or STATIONING
[illegible]06	FMC Pond 8S	N 450,017.7 : E 554,927.8

[illegible]	COMPLETED	PREPARED BY	REFERENCE POINT FOR MEASUREMENTS
10-17-98	10-17-98	L. R. West	Top of PVC Casing-Water Levels



	DEPTH (FT)	ELEV. (FTMSL)
TOP OF SURFACE CASING	-3	4497.33
TOP OF RISER CASING	-2.8	4497.13
GROUND SURFACE	0.0	4494.3
BOTTOM OF SURFACE CASING	2.0	4492.3
TOP OF SEAL	85.0	4409.3
TOP OF FILTER PACK	95.0	4399.3
TOP OF SCREEN	100.0	4394.3
BOTTOM OF SCREEN	115.0	4379.3
BOTTOM OF SUMP	117.9	4376.5
BOTTOM OF HOLE	119.7	4374.6

NOT TO SCALE

WMUs # 8 and #11

(PHASE IV PONDS and POND 8E)

WELL COMPLETION DIAGRAMS

MONITORING WELL

JOB NO.	SITE	PROJECT	WELL NO.
21372	NE of Ponds 8E and 11S-14S	EMF POCATELLO, ID	104

BEGUN	COMPLETED	PREPARED BY	COORDINATES and/or STATIONING
11-7-90	11-7-90	Curtis Obi	N 450,146 E 554,270

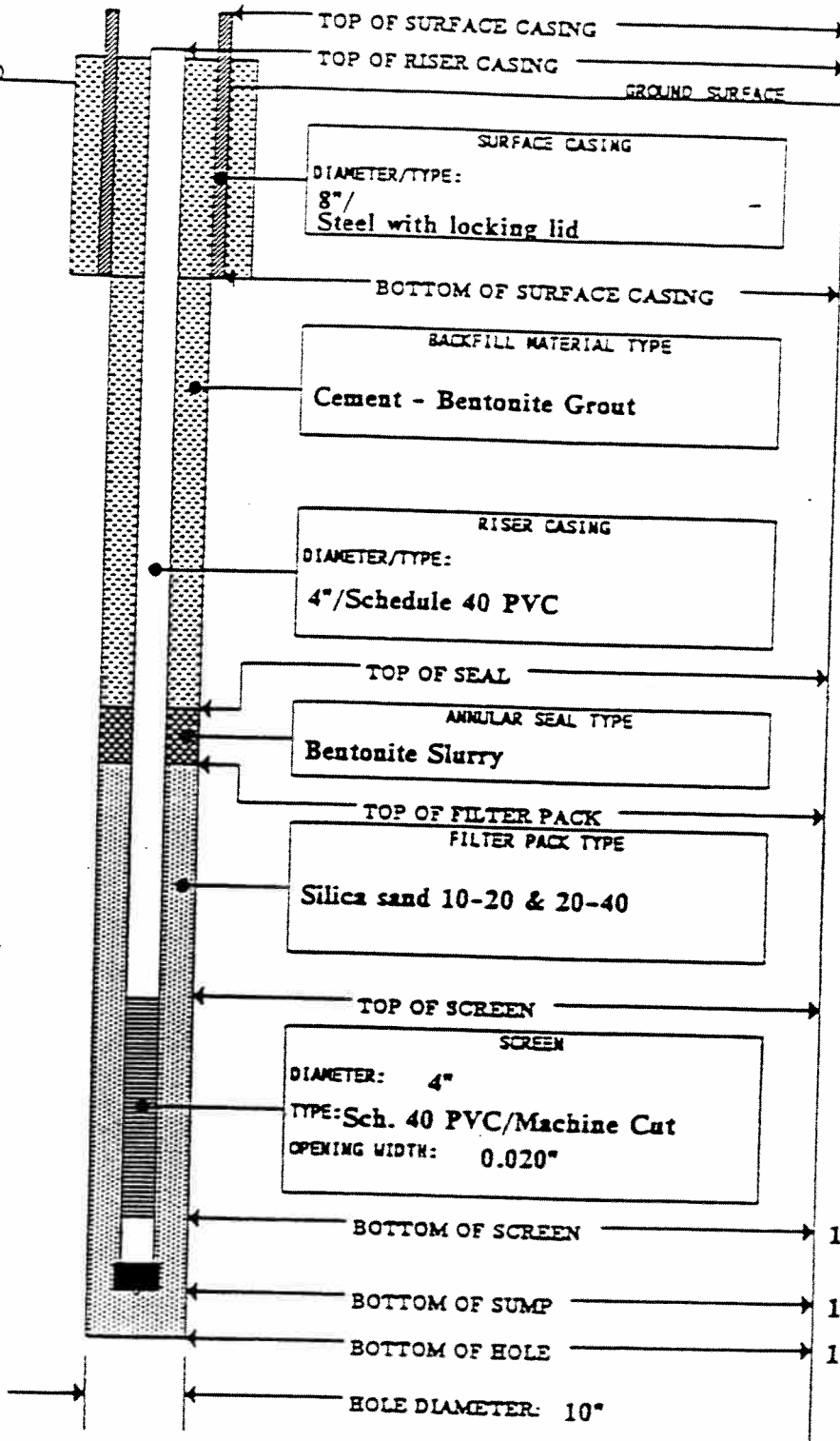
REFERENCE POINT FOR MEASUREMENTS: Top of PVC casing(Water level)

(GENERALIZED GEOLOGIC LOG)

See Boring Logs.

Plugged on: 11-6-90

NOT TO SCALE



	DEPTH (FT)	ELEV. (FTMSL)
TOP OF SURFACE CASING	2.4	4487.0
TOP OF RISER CASING	2.1	4486.7
GROUND SURFACE	0.0	4484.6
BOTTOM OF SURFACE CASING	2.6	4482.0
TOP OF SEAL	84.0	4400.6
TOP OF FILTER PACK	88.0	4396.6
TOP OF SCREEN	96.5	4388.1
BOTTOM OF SCREEN	106.5	4378.1
BOTTOM OF SUMP	109.0	4375.6
BOTTOM OF HOLE	110.0	4374.6

Update: 8-12-92
Template: ZWELLOG

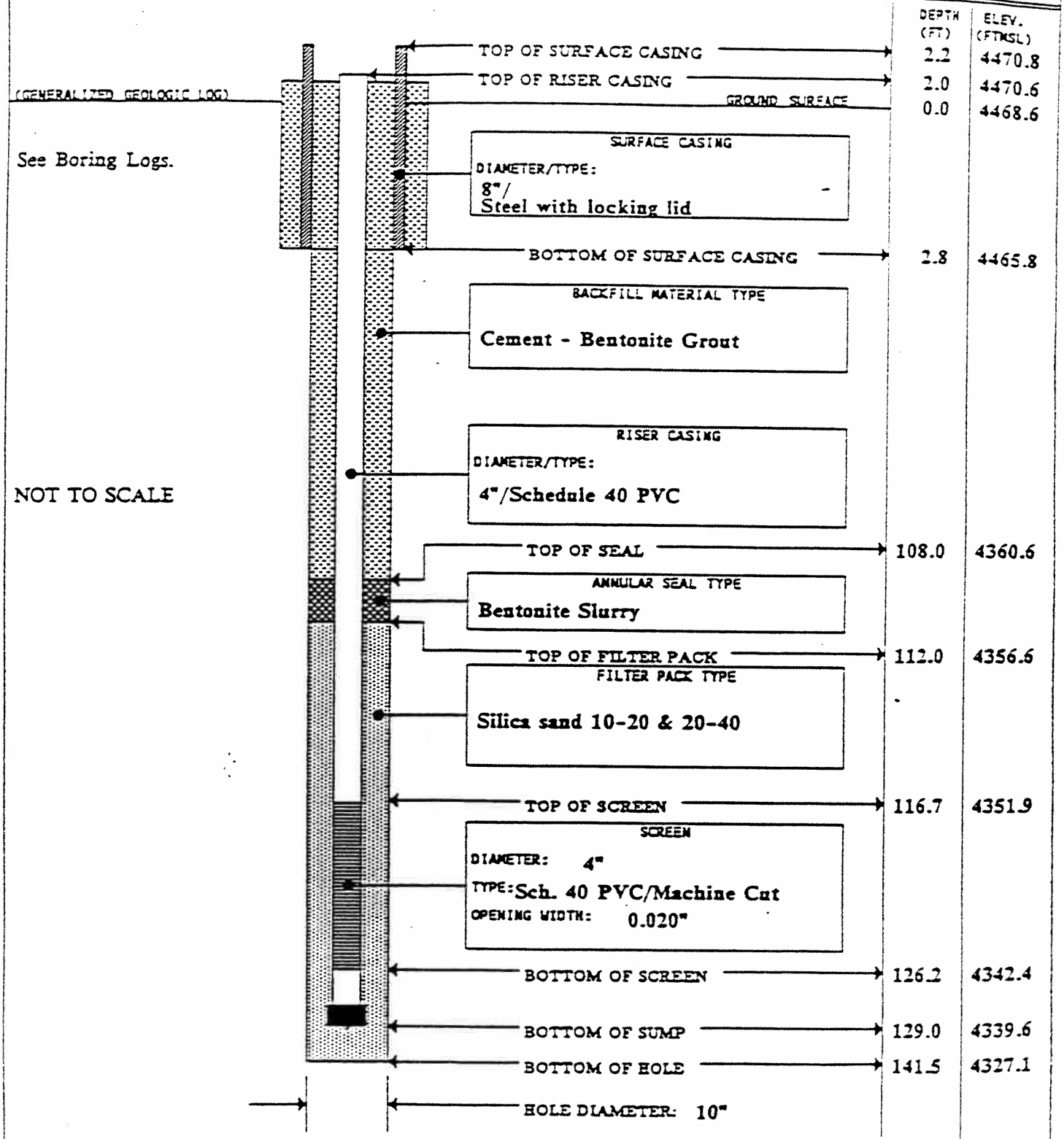
NOT TO SCALE

MONITORING WELL

PROJECT	WELL NO.
EMF POCATELLO, ID	114

JOB NO.	SITE	COORDINATES and/or STATIONING
21372	Northeast of Pond 15S	N 449,849 E 553,030

BEGUN	COMPLETED	PREPARED BY	REFERENCE POINT FOR MEASUREMENTS
10-16-90	10-17-90	Garrett Day	Top of PVC casing(Water level)



	DEPTH (FT)	ELEV. (FTMSL)
TOP OF SURFACE CASING	2.2	4470.8
TOP OF RISER CASING	2.0	4470.6
GROUND SURFACE	0.0	4468.6
BOTTOM OF SURFACE CASING	2.8	4465.8
TOP OF SEAL	108.0	4360.6
TOP OF FILTER PACK	112.0	4356.6
TOP OF SCREEN	116.7	4351.9
BOTTOM OF SCREEN	126.2	4342.4
BOTTOM OF SUMP	129.0	4339.6
BOTTOM OF HOLE	141.5	4327.1

Update: 11-10-93
Template: ZWELLOG

NOT TO SCALE

MONITORING WELL

PROJECT	WELL NO.
EMF POCATELLO, ID	131

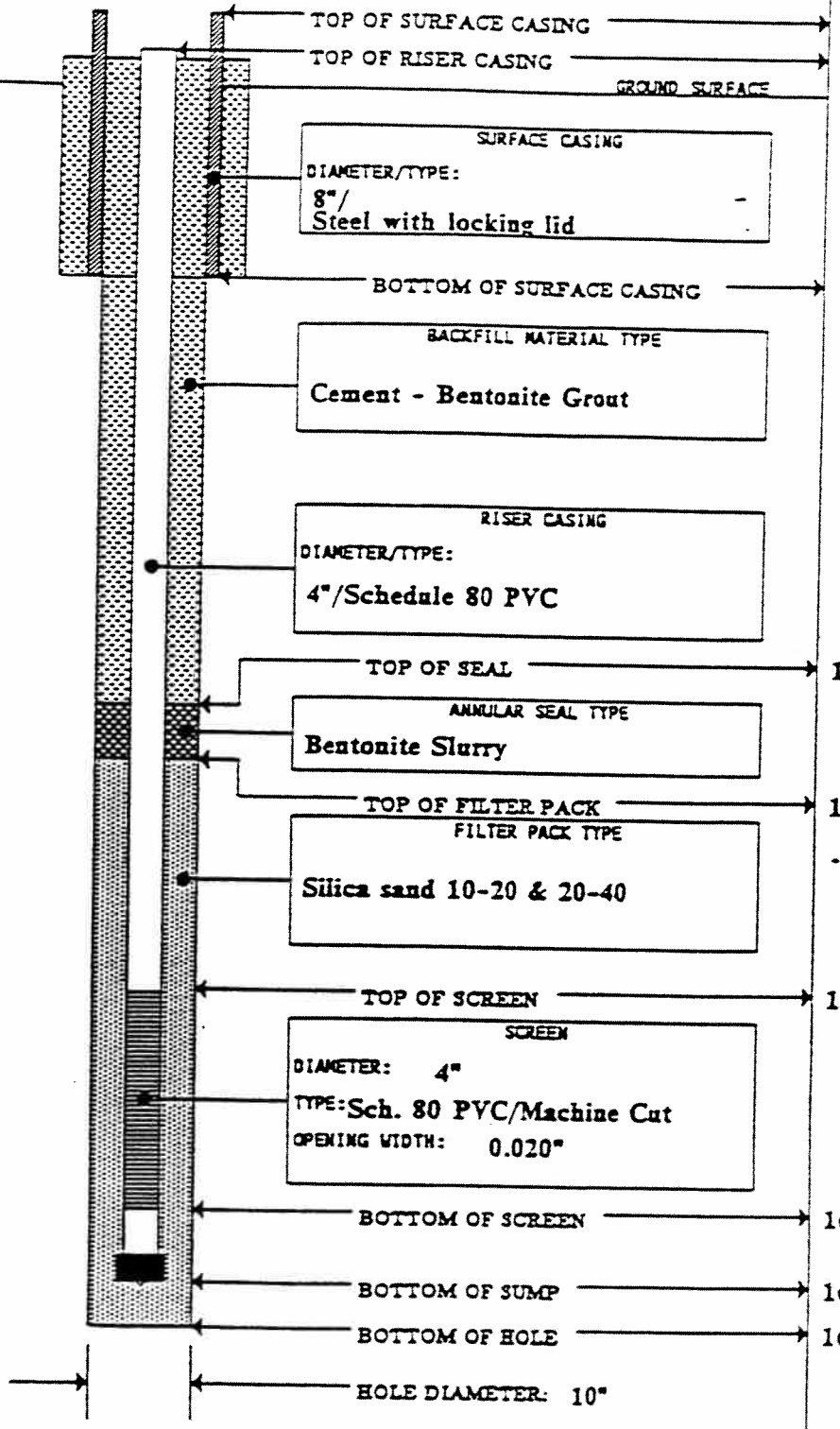
JOB NO.	SITE	COORDINATES and/or STATIONING
21372	N of Ponds 8E and 11S-14S	N 450,212 E 553,743

BEGUN	COMPLETED	PREPARED BY	REFERENCE POINT FOR MEASUREMENTS
10-23-90	10-23-90	Garrett Day	Top of PVC casing(Water level)

(GENERALIZED GEOLOGIC LOG)

See Boring Logs.

NOT TO SCALE



	DEPTH (FT)	ELEV. (FTMSL)
TOP OF SURFACE CASING	1.7	4486.2
TOP OF RISER CASING	1.4	4485.9
GROUND SURFACE	0.0	4484.5
BOTTOM OF SURFACE CASING	3.3	4481.2
TOP OF SEAL	143.0	4341.5
TOP OF FILTER PACK	147.0	4337.5
TOP OF SCREEN	153.9	4330.6
BOTTOM OF SCREEN	163.9	4320.6
BOTTOM OF SUMP	165.6	4318.9
BOTTOM OF HOLE	167.0	4317.5

Update: 11-10-93
Template: ZWELLOG

NOT TO SCALE

MONITORING WELL

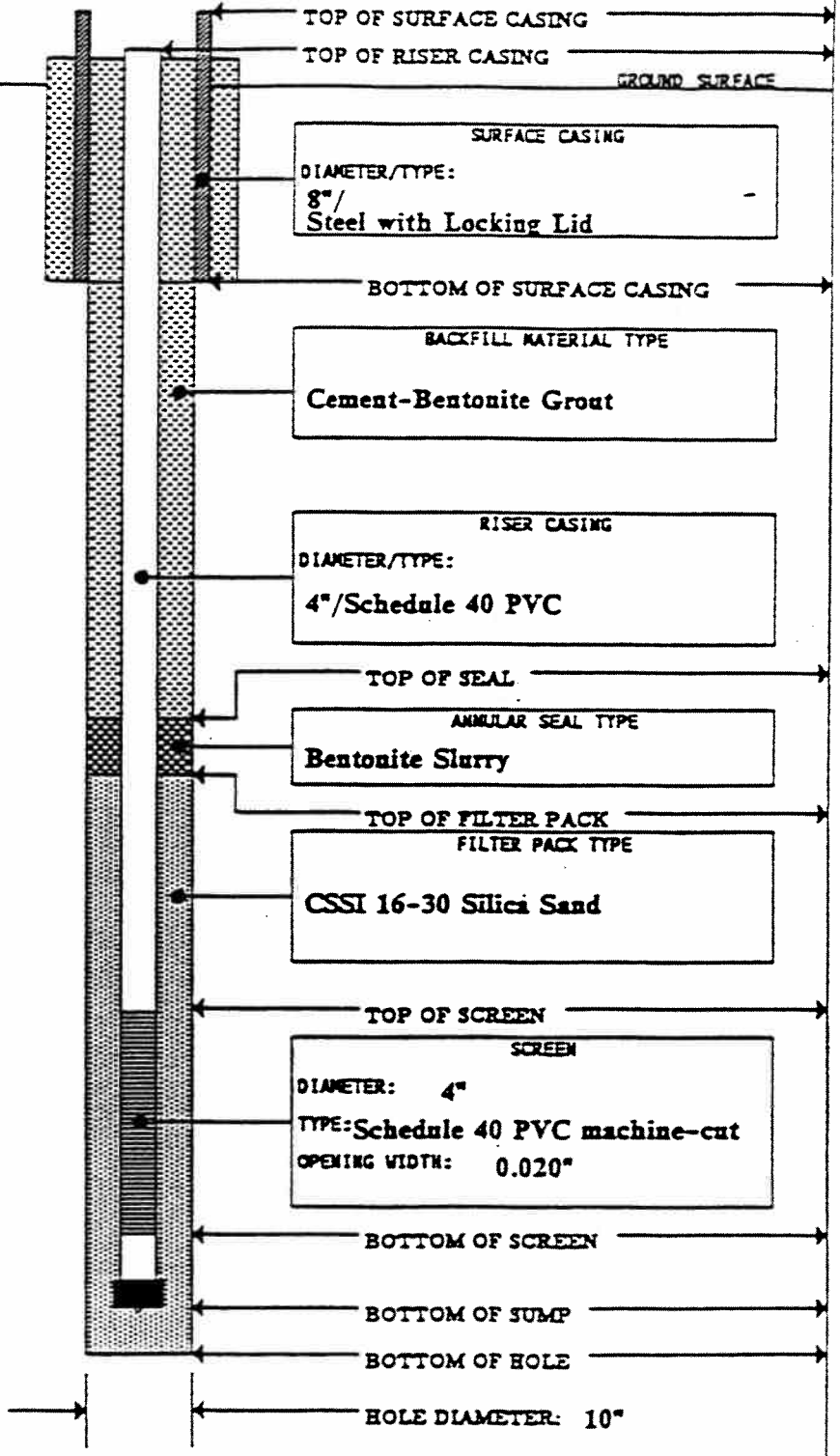
PROJECT	WELL NO.
EMF POCATELLO, ID	167

JOB NO.	SITE	COORDINATES and/or STATIONING
21372	FMC Corporation	N 449,404 E 554,016

BEGUN	COMPLETED	PREPARED BY	REFERENCE POINT FOR MEASUREMENTS
8-23-95	8-24-95	Curtis Obi	Top of PVC Casing-Water Levels

(GENERALIZED GEOLOGIC LOG)

See Geologic Drill Log for Details.



	DEPTH (FT)	ELEV. (FTMSL)
TOP OF SURFACE CASING	2.5	4492.6
TOP OF RISER CASING	2.1	4492.2
GROUND SURFACE	0.0	4490.1
BOTTOM OF SURFACE CASING	2.5	4487.6
TOP OF SEAL	103.5	4386.6
TOP OF FILTER PACK	113.5	4376.6
TOP OF SCREEN	116.5	4373.6
BOTTOM OF SCREEN	136.5	4353.6
BOTTOM OF SUMP	139.0	4351.1
BOTTOM OF HOLE	139.0	4351.1

Update: 10-19-95
Template: 2WELLOG

NOT TO SCALE

MONITORING WELL

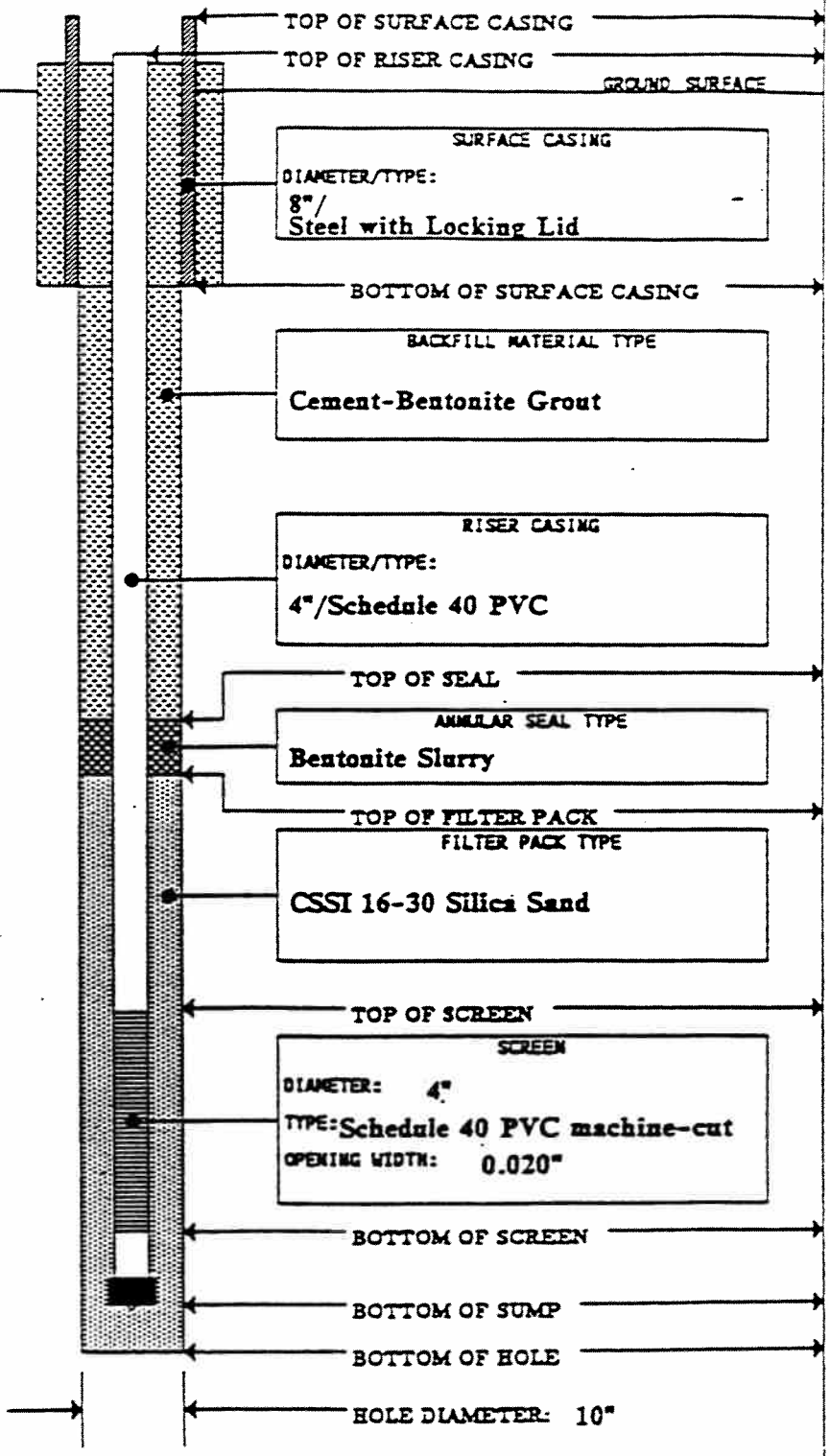
PROJECT	WELL NO.
EMF POCATELLO, ID	168

JOB NO.	SITE	COORDINATES and/or STATIONING
21372	FMC Corporation	N 450,082 E 553,286

BEGUN	COMPLETED	PREPARED BY	REFERENCE POINT FOR MEASUREMENTS
8-30-95	8-30-95	Curtis Obi	Top of PVC Casing-Water Levels

(GENERALIZED GEOLOGIC LOG)

See Geologic Drill Log for Details.



	DEPTH (FT)	ELEV. (FTMSL)
TOP OF SURFACE CASING	2.7	4474.3
TOP OF RISER CASING	2.3	4473.9
GROUND SURFACE	0.0	4471.6
BOTTOM OF SURFACE CASING	2.3	4469.3
TOP OF SEAL	61.0	4410.6
TOP OF FILTER PACK	71.0	4400.6
TOP OF SCREEN	75.5	4396.1
BOTTOM OF SCREEN	90.5	4381.1
BOTTOM OF SUMP	93.0	4378.6
BOTTOM OF HOLE	93.5	4378.1

Update: 10-19-95
Template: ZWELLOG

NOT TO SCALE

WMU # 9 (POND 9E)

WELL COMPLETION DIAGRAMS

MONITORING WELL

PROJECT	WELL NO.
EMF POCATELLO, ID	113

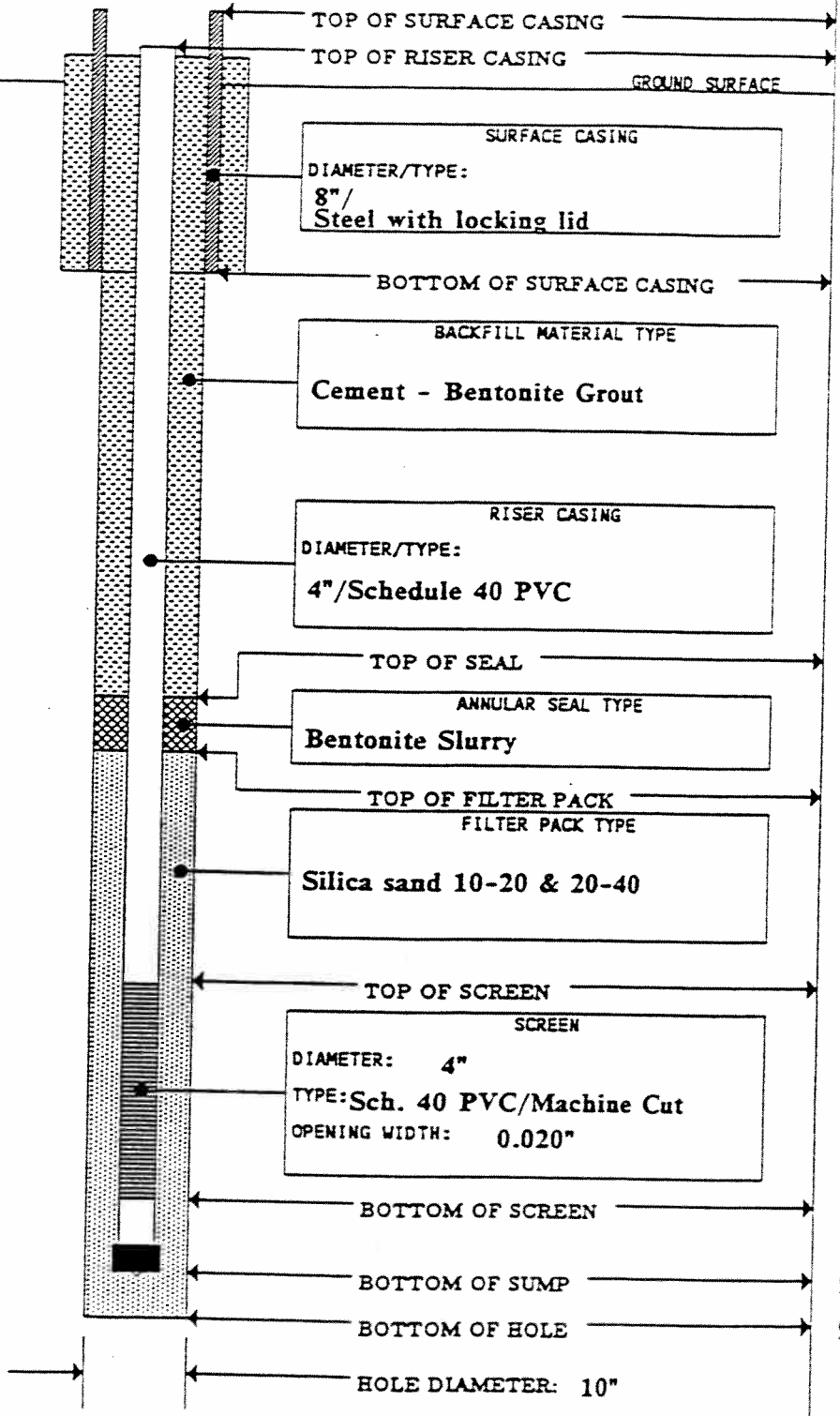
JOB NO.	SITE	COORDINATES and/or STATIONING
21372	North of Pond 15S	N 449,982 E 552,482

BEGUN	COMPLETED	PREPARED BY	REFERENCE POINT FOR MEASUREMENTS
10-15-90	10-16-90	Garrett Day	Top of PVC casing(Water level)

(GENERALIZED GEOLOGIC LOG)

See Boring Logs.

NOT TO SCALE



	DEPTH (FT)	ELEV. (FTMSL)
TOP OF SURFACE CASING	2.1	4463.3
TOP OF RISER CASING	1.8	4463.0
GROUND SURFACE	0.0	4461.2
BOTTOM OF SURFACE CASING	2.9	4458.2
TOP OF SEAL	73.0	4388.2
TOP OF FILTER PACK	77.0	4384.2
TOP OF SCREEN	82.2	4379.0
BOTTOM OF SCREEN	91.7	4369.5
BOTTOM OF SUMP	94.5	4366.7
BOTTOM OF HOLE	97.0	4364.2

Update: 11-10-93
Template: 2WELLOG

NOT TO SCALE

MONITORING WELL

PROJECT	WELL NO.
EMF POCATELLO, ID	124

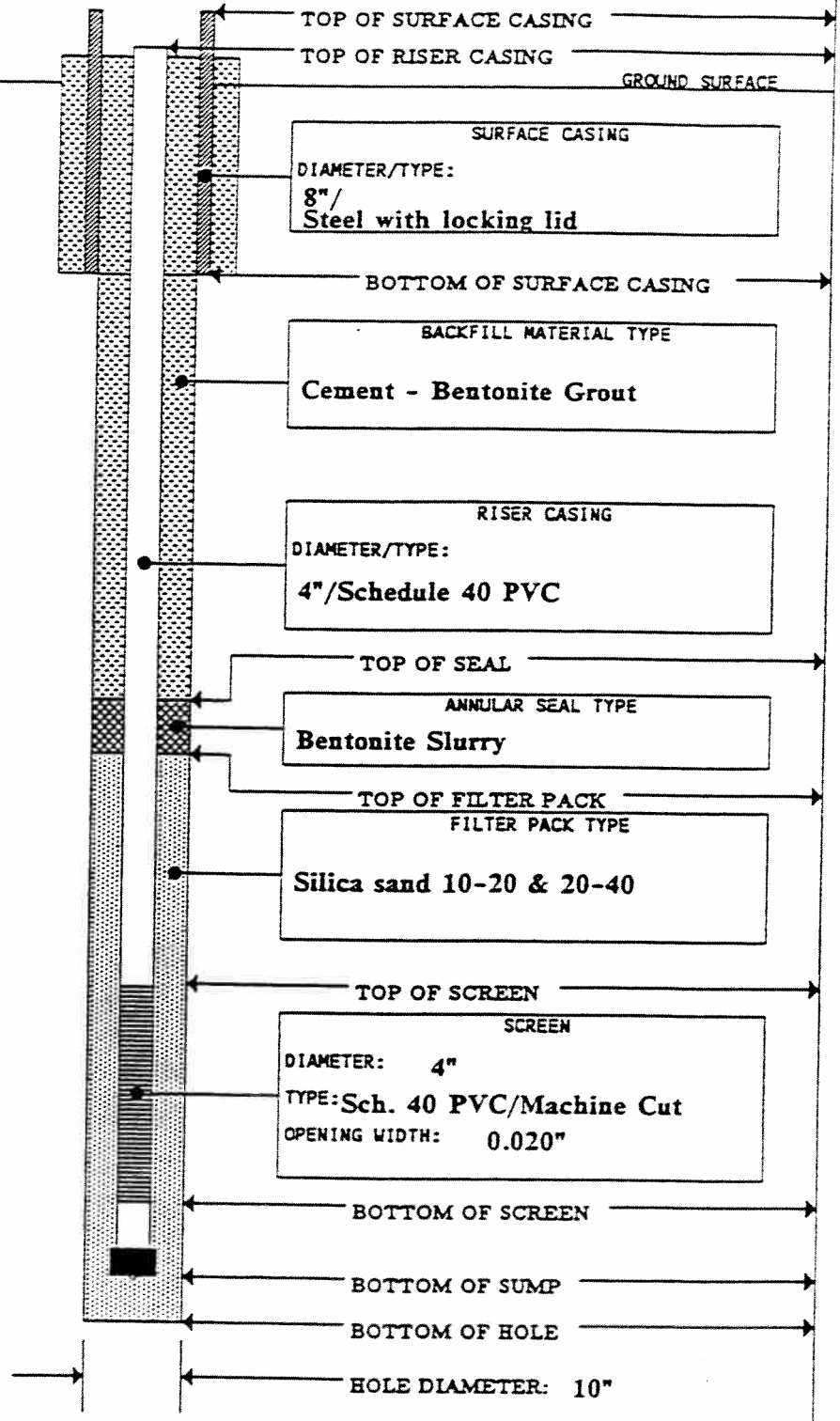
JOB NO.	SITE	COORDINATES and/or STATIONING
21372	West of Pond 9E	N 450,362 E 552,029

BEGUN	COMPLETED	PREPARED BY	REFERENCE POINT FOR MEASUREMENTS
10-22-90	10-22-90	Garrett Day	Top of PVC casing(Water level)

(GENERALIZED GEOLOGIC LOG)

See Boring Logs.

NOT TO SCALE



	DEPTH (FT)	ELEV. (FTMSL)
TOP OF SURFACE CASING	2.1	4448.7
TOP OF RISER CASING	1.8	4448.4
GROUND SURFACE	0.0	4446.6
BOTTOM OF SURFACE CASING	2.9	4443.7
TOP OF SEAL	62.5	4384.1
TOP OF FILTER PACK	66.5	4380.1
TOP OF SCREEN	72.6	4374.0
BOTTOM OF SCREEN	82.1	4364.5
BOTTOM OF SUMP	84.8	4361.8
BOTTOM OF HOLE	85.0	4361.6

Update: 8-12-92
Template: 2WELLOG

NOT TO SCALE

MONITORING WELL

PROJECT	WELL NO.
EMF POCATELLO, ID	126

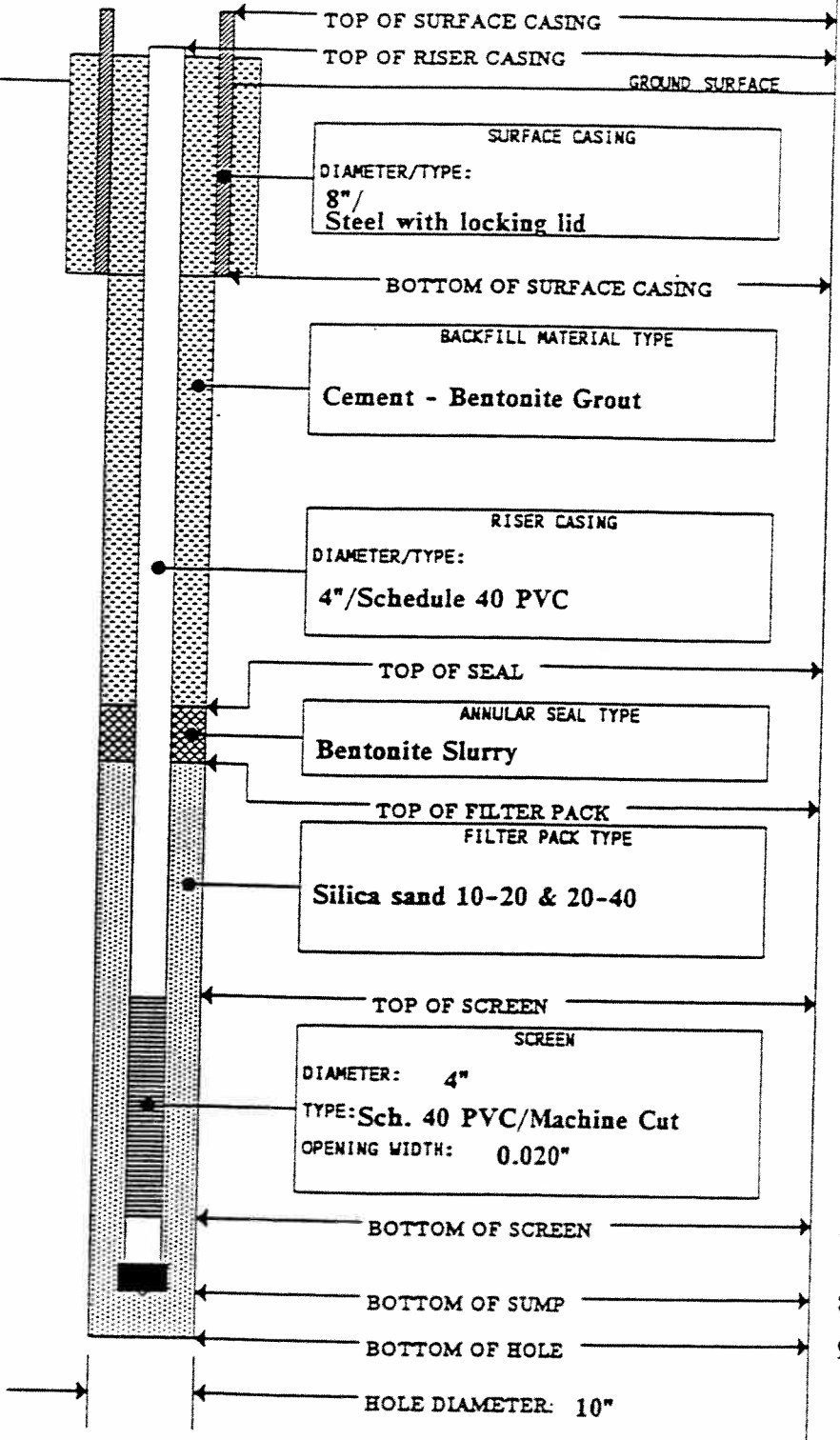
JOB NO.	SITE	COORDINATES and/or STATIONING
21372	North of Pond 9E	N 451,223 E 552,430

BEGUN	COMPLETED	PREPARED BY	REFERENCE POINT FOR MEASUREMENTS
10-16-90	10-17-90	Curtis Obi	Top of PVC casing(Water level)

(GENERALIZED GEOLOGIC LOG)

See Boring Logs.

NOT TO SCALE



	DEPTH (FT)	ELEV. (FTMSL)
TOP OF SURFACE CASING	2.2	4456.2
TOP OF RISER CASING	2.0	4556.0
GROUND SURFACE	0.0	4454.0
BOTTOM OF SURFACE CASING	2.8	4451.2
TOP OF SEAL	65.0	4389.0
TOP OF FILTER PACK	69.0	4385.0
TOP OF SCREEN	75.5	4378.5
BOTTOM OF SCREEN	85.5	4368.5
BOTTOM OF SUMP	88.0	4366.0
BOTTOM OF HOLE	90.0	4364.0

Update: 8-12-92
Template: ZWELLOG

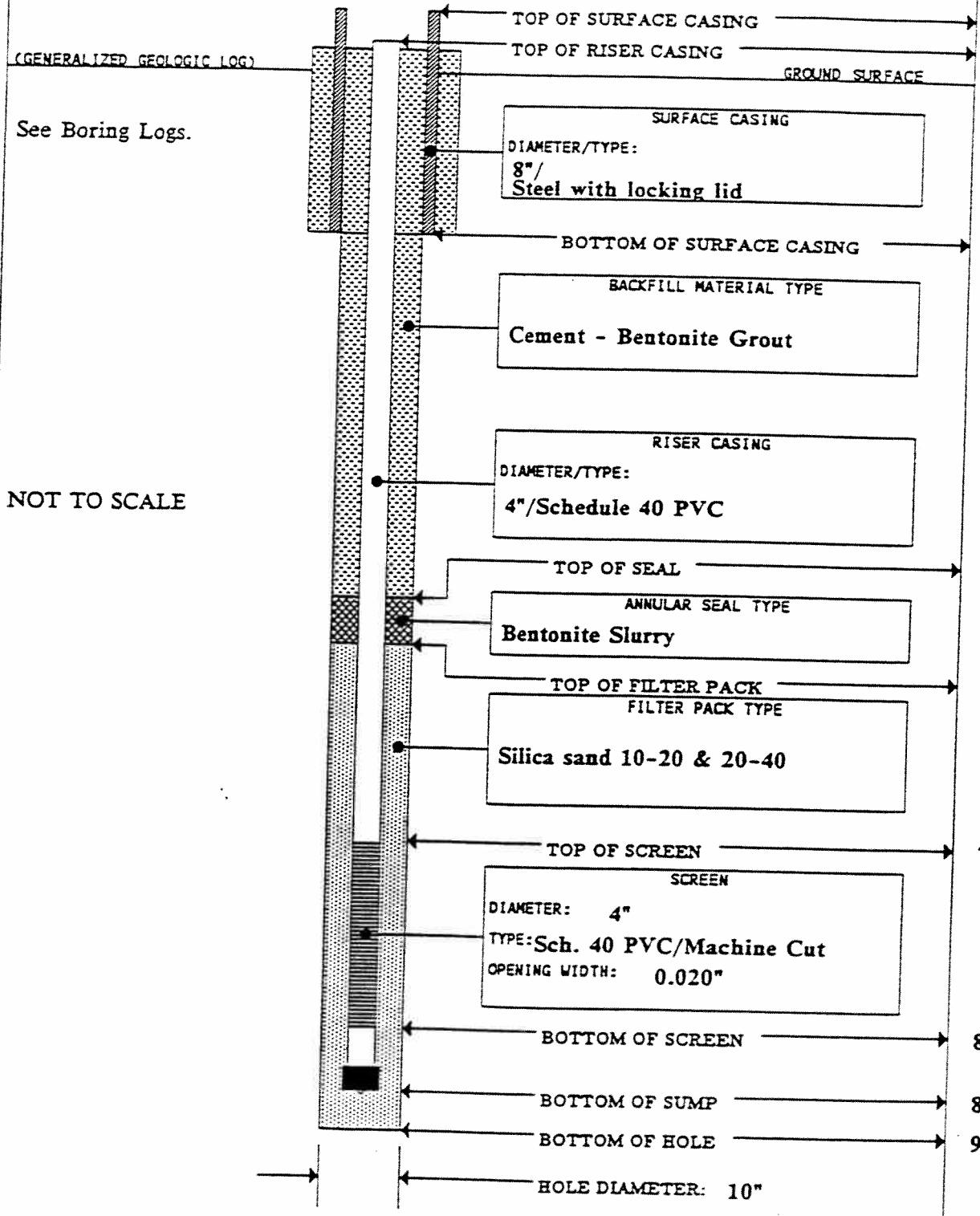
NOT TO SCALE

MONITORING WELL

JOB NO.	SITE	PROJECT	WELL NO.
21372	Northeast of Pond 9E	EMF POCATELLO, ID	127

COORDINATES and/or STATIONING	
N 451,068 E 552,687	

BEGUN	COMPLETED	PREPARED BY	REFERENCE POINT FOR MEASUREMENTS
10-13-90	10-13-90	Garrett Day	Top of PVC casing(Water level)



	DEPTH (FT)	ELEV. (FTMSL)
TOP OF SURFACE CASING	2.1	4458.5
TOP OF RISER CASING	1.8	4458.2
GROUND SURFACE	0.0	4456.4
BOTTOM OF SURFACE CASING	2.9	4453.5
TOP OF SEAL	68.0	4388.0
TOP OF FILTER PACK	72.0	4384.0
TOP OF SCREEN	77.0	4379.4
BOTTOM OF SCREEN	86.5	4369.9
BOTTOM OF SUMP	89.3	4367.1
BOTTOM OF HOLE	90.5	4365.9

Update: 8-12-92
Template: 2WELLOG

NOT TO SCALE

MONITORING WELL

PROJECT	WELL NO.
EMF POCATELLO, ID	128

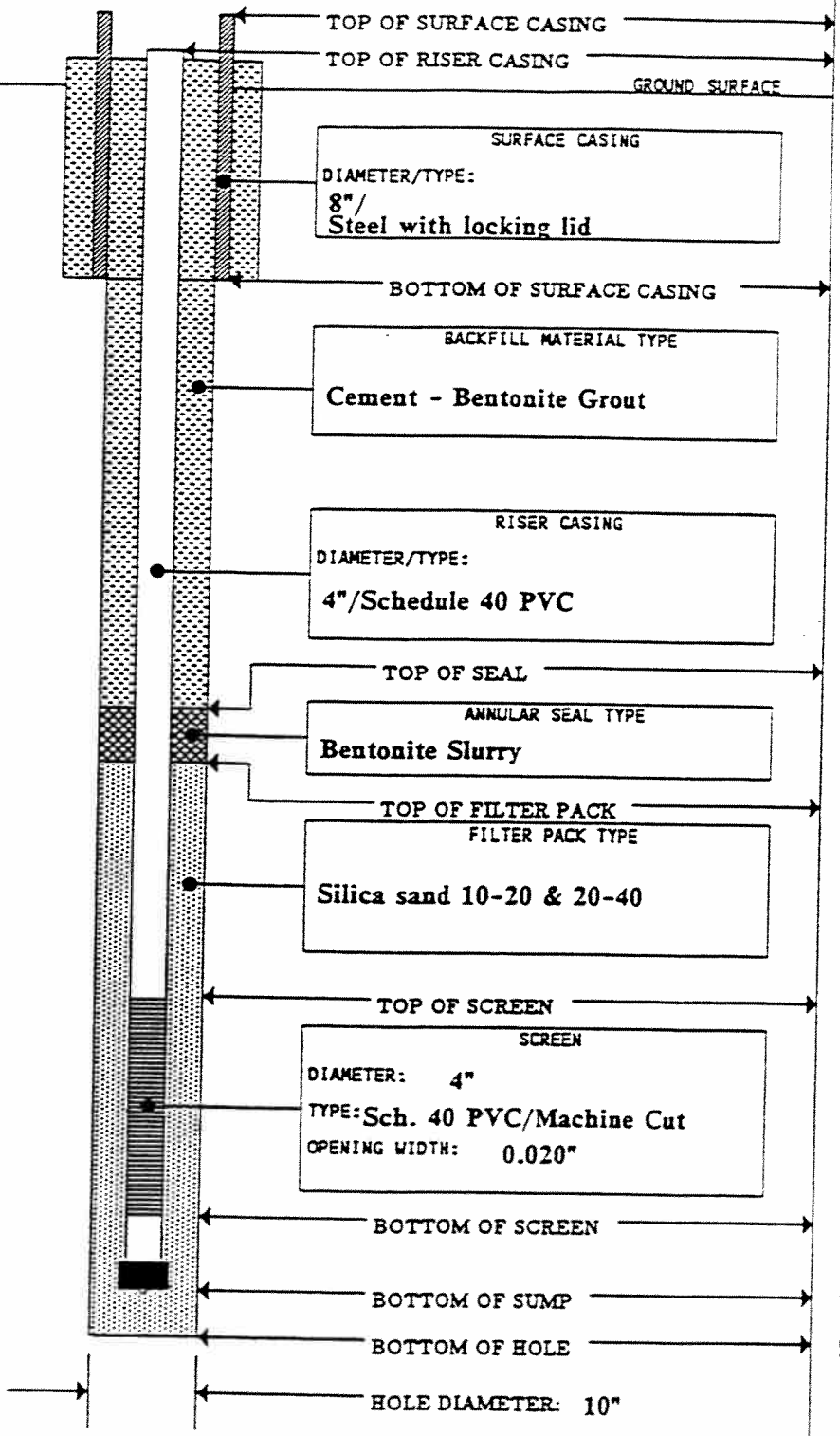
JOB NO.	SITE	COORDINATES and/or STATIONING
21372	East of Pond 9E	N 450,494 E 552,684

BEGUN	COMPLETED	PREPARED BY	REFERENCE POINT FOR MEASUREMENTS
10-14-90	10-15-90	Garrett Day	Top of PVC casing(Water level)

(GENERALIZED GEOLOGIC LOG)

See Boring Logs.

NOT TO SCALE



	DEPTH (FT)	ELEV. (FTMSL)
TOP OF SURFACE CASING	2.1	4462.1
TOP OF RISER CASING	1.9	4461.9
GROUND SURFACE	0.0	4460.0
BOTTOM OF SURFACE CASING	2.9	4457.1
TOP OF SEAL	75.0	4384.5
TOP OF FILTER PACK	79.5	4380.5
TOP OF SCREEN	84.3	4375.7
BOTTOM OF SCREEN	93.8	4366.2
BOTTOM OF SUMP	96.5	4363.5
BOTTOM OF HOLE	97.0	4363.0

Update: 8-12-92
Template: 2WELLOG

NOT TO SCALE

WMU # 10 (POND 16S)

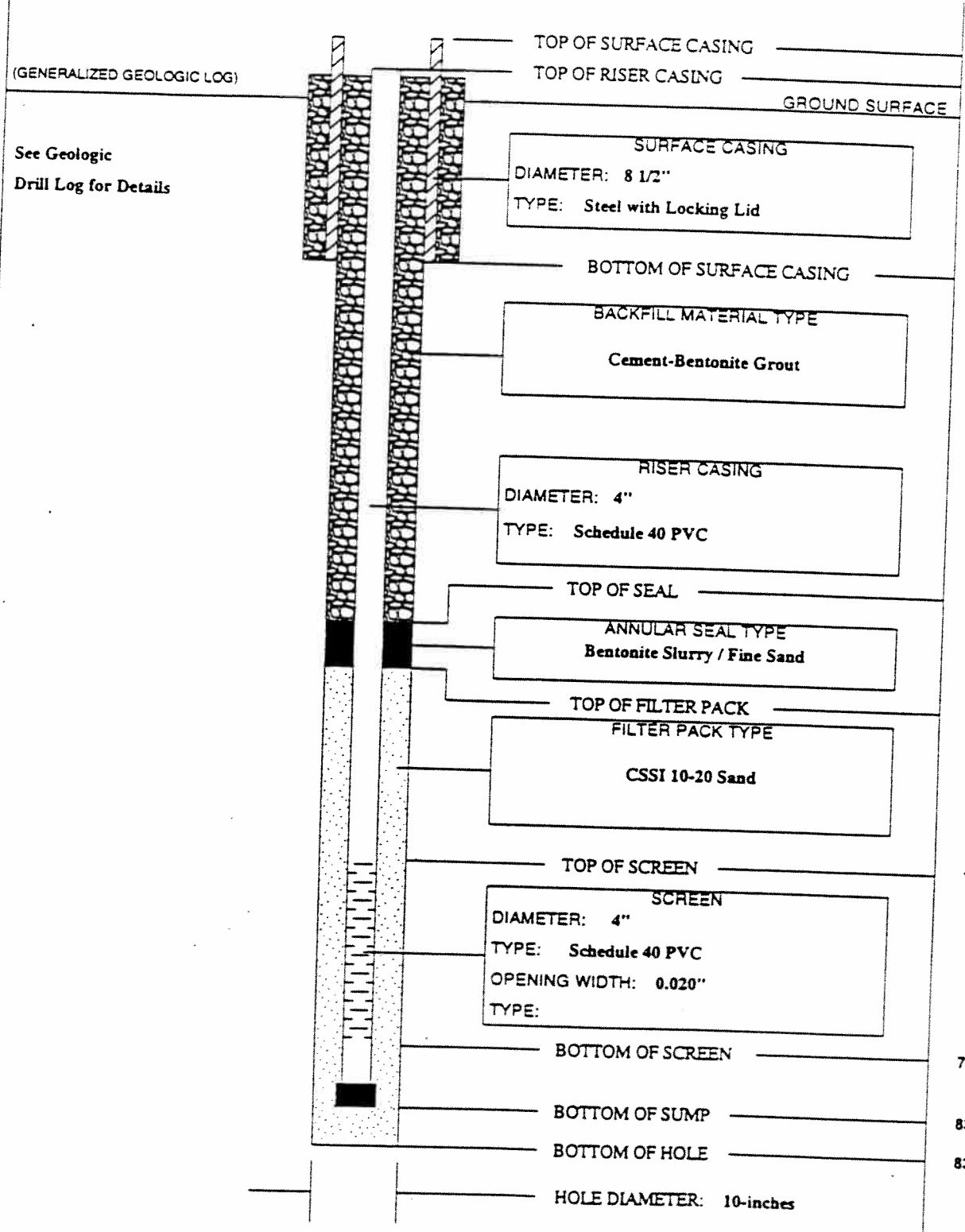
WELL COMPLETION DIAGRAMS

MONITORING WELL

PROJECT	WELL NO.
EMF POCATELLO, ID	147

JOB NO.	SITE	COORDINATES and / or STATIONING
20906	FMC Corporation	N 450,622.8 : E 550,769.3

BEGUN	COMPLETED	PREPARED BY	REFERENCE POINT FOR MEASUREMENTS
5-10-92	5-10-92	Garrett Day	Top of PVC Casing-Water Level



	DEPTH (FT)	ELEV. (FTMSL)
TOP OF SURFACE CASING	-1.8	~~4444.1~~
TOP OF RISER CASING	-1.4	4443.7
GROUND SURFACE	0.0	~~4442.3~~
BOTTOM OF SURFACE CASING	3.2	4439.1
TOP OF SEAL	60.0	4382.3
TOP OF FILTER PACK	65.0	4377.3
TOP OF SCREEN	70.7	4371.6
BOTTOM OF SCREEN	79.7	4362.6
BOTTOM OF SUMP	83.2	4359.1
BOTTOM OF HOLE	83.5	4358.8

NOT TO SCALE

MONITORING WELL

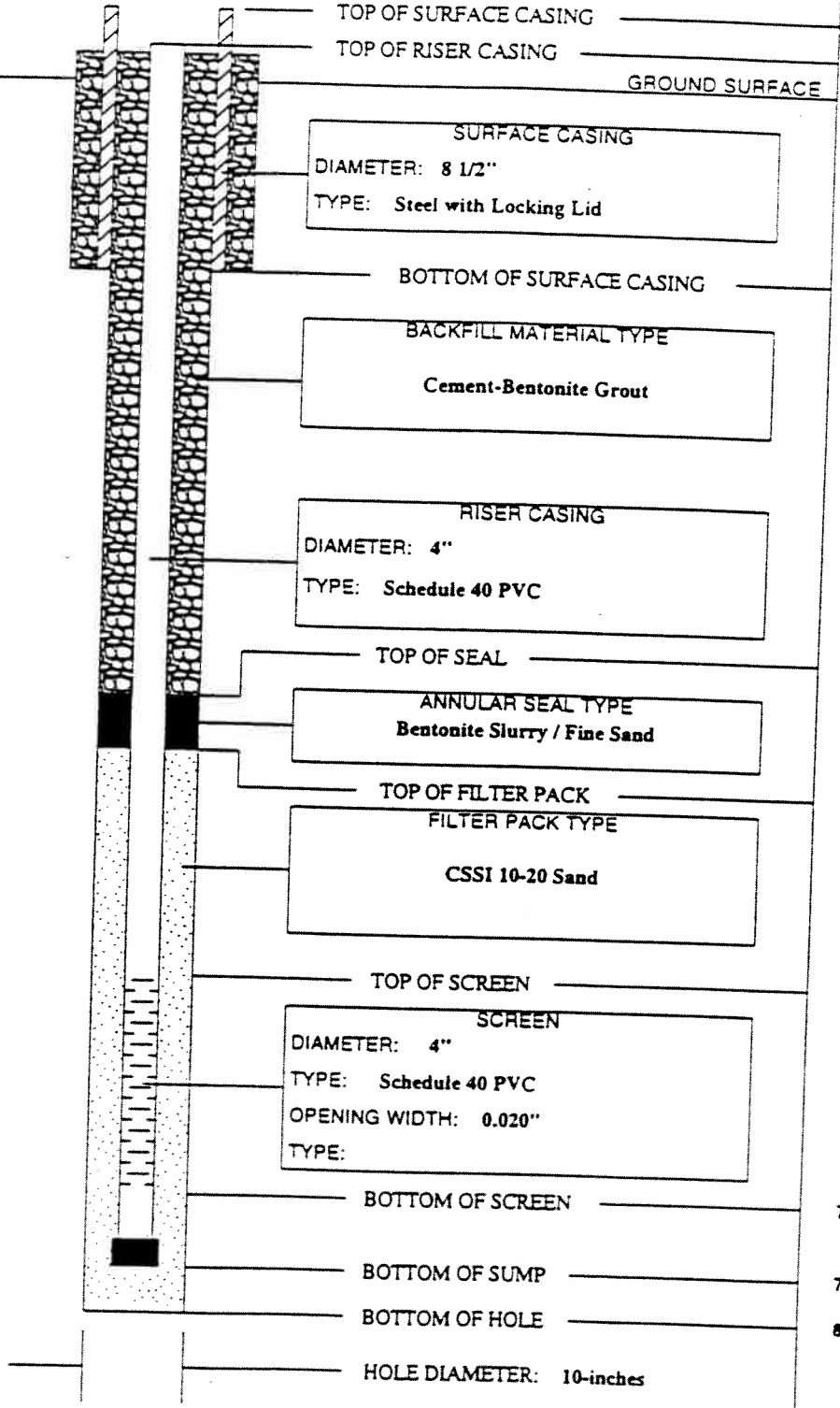
PROJECT	WELL NO
EMF POCATELLO, ID	148

JOB NO.	SITE	COORDINATES and / or STATIONING
20906	FMC Corporation	N 450,479.4 : E 551,187.8

BEGUN	COMPLETED	PREPARED BY	REFERENCE POINT FOR MEASUREMENTS
5-12-92	5-12-92	Garrett Day	Top of PVC Casing-Water Level

(GENERALIZED GEOLOGIC LOG)

See Geologic Drill Log for Details



	DEPTH (FT)	ELEV. (FTMSL)
TOP OF SURFACE CASING	-1.7	~~4446.7~~
TOP OF RISER CASING	-1.5	~~4446.5~~
GROUND SURFACE	0.0	~~4445.0~~
BOTTOM OF SURFACE CASING	3.3	4441.7
TOP OF SEAL	55.0	4390.0
TOP OF FILTER PACK	60.0	4385.0
TOP OF SCREEN	67.1	4377.9
BOTTOM OF SCREEN	76.1	4368.9
BOTTOM OF SUMP	79.6	4365.4
BOTTOM OF HOLE	80.0	4365.0

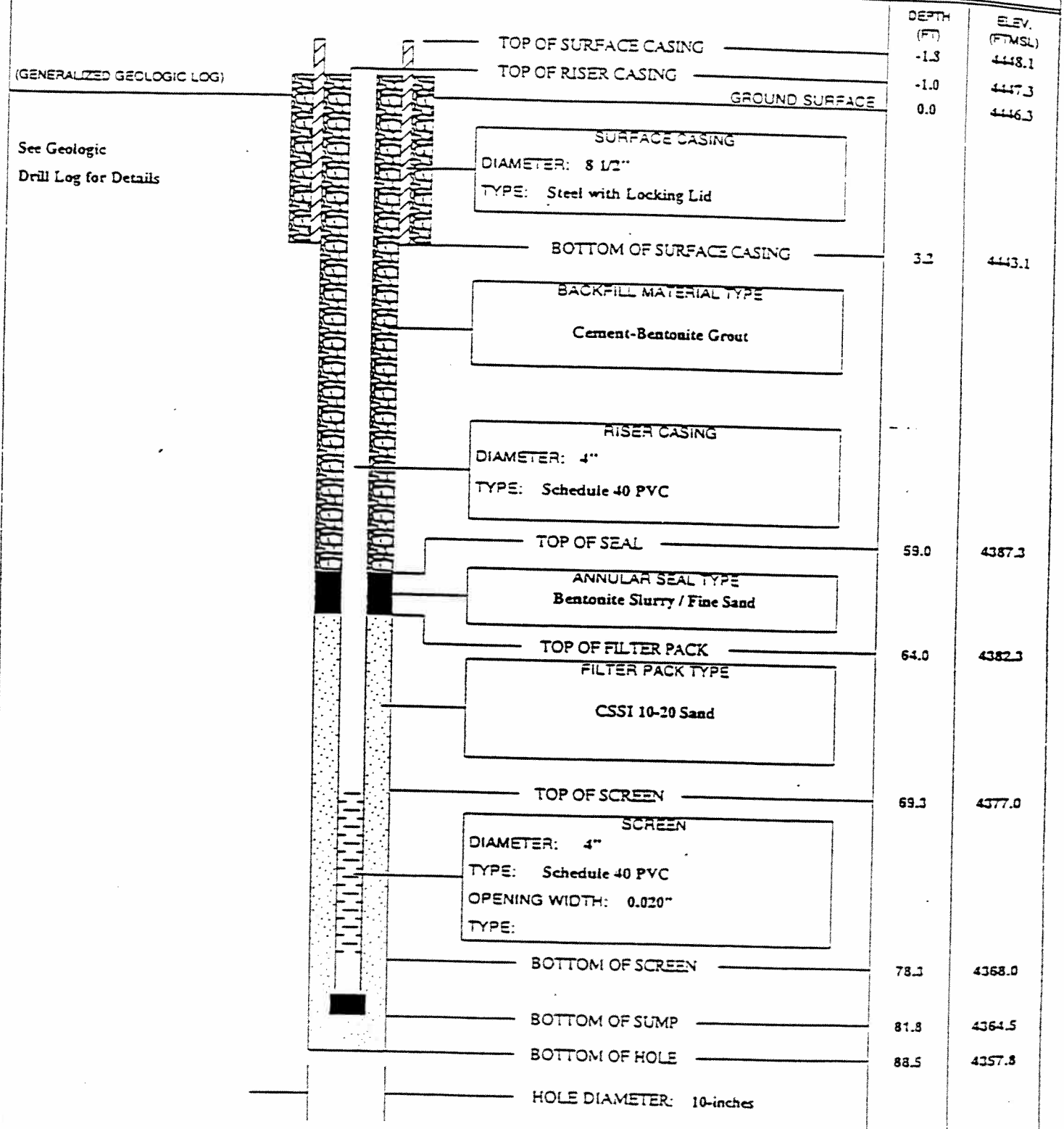
NOT TO SCALE

MONITORING WELL

JOB NO.	SITE	COORDINATES and / or STATIONING	WELL NO.
20906	FMC Corporation	N 450,047.3 : E 551,254.4	149

PROJECT: EMF POCATELLO, ID

BEGUN	COMPLETED	PREPARED BY	REFERENCE POINT FOR MEASUREMENTS
5-11-92	5-11-92	H. Feng	Top of PVC Casing-Water Level



	DEPTH (FT)	ELEV. (FTMSL)
TOP OF SURFACE CASING	-1.3	4448.1
TOP OF RISER CASING	-1.0	4447.3
GROUND SURFACE	0.0	4446.3
BOTTOM OF SURFACE CASING	3.2	4443.1
TOP OF SEAL	59.0	4387.3
TOP OF FILTER PACK	64.0	4382.3
TOP OF SCREEN	69.3	4377.0
BOTTOM OF SCREEN	78.3	4368.0
BOTTOM OF SUMP	81.8	4364.5
BOTTOM OF HOLE	88.5	4357.8

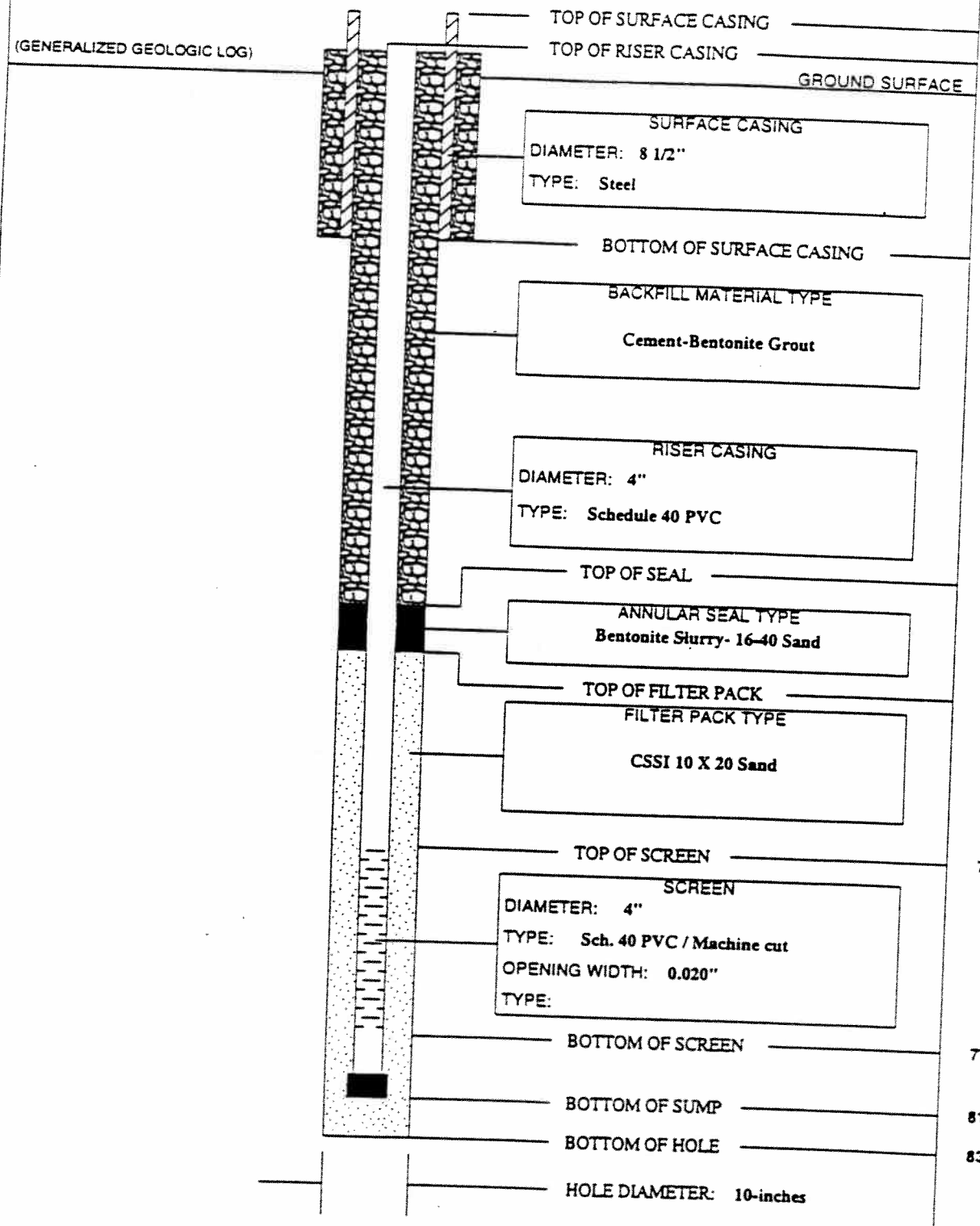
NOT TO SCALE

MONITORING WELL

JOB NO.	SITE	PROJECT	WELL NO.
20906	FMC Corporation	EMF POCATELLO, ID	154

BEGUN	COMPLETED	PREPARED BY	COORDINATES and / or STATIONING
11-2-92	11-2-92	G. Day	N 449,702.0 : E 550,197.8

REFERENCE POINT FOR MEASUREMENTS: Top of PVC Casing-Water Level



	DEPTH (FT)	ELEV. (FTMSL)
TOP OF SURFACE CASING	-2.3	4447.6
TOP OF RISER CASING	-1.7	4447
GROUND SURFACE	0.0	4445.3
BOTTOM OF SURFACE CASING	2.7	4442.6
TOP OF SEAL	63.0	4382.3
TOP OF FILTER PACK	68.0	4377.3
TOP OF SCREEN	73.6	4371.7
BOTTOM OF SCREEN	77.8	4367.5
BOTTOM OF SUMP	81.1	4364.2
BOTTOM OF HOLE	83.0	4362.3

NOT TO SCALE

Update: Oct 07, 1997

Report Form: EMF-WELLOG2

WMU # 14 (POND 17)

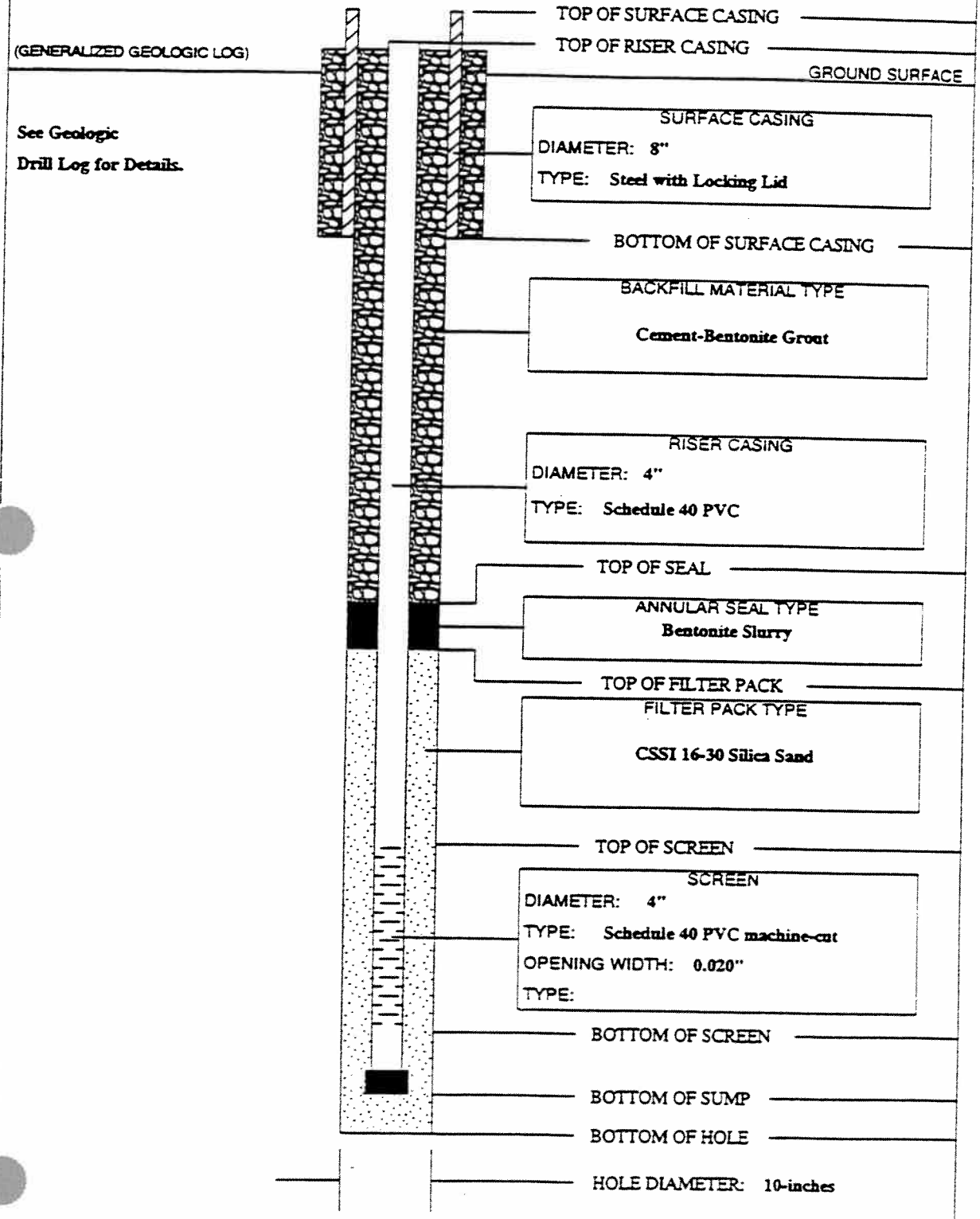
WELL COMPLETION DIAGRAMS

MONITORING WELL

PROJECT	WELL NO.
EMF POCATELLO, ID	171

JOB NO.	SITE	COORDINATES and / or STATIONING
20906	FMC Corporation	N 449,596.5 : E 551,237.2

RUN	COMPLETED	PREPARED BY	REFERENCE POINT FOR MEASUREMENTS
9-6-95	9-6-95	Curtis Obi	Top of PVC Casing-Water Levels



	DEPTH (FT)	ELEV. (FTMSL)
TOP OF SURFACE CASING	-2.8	4452.7
TOP OF RISER CASING	-2.5	4452.41
GROUND SURFACE	0.0	4449.9
BOTTOM OF SURFACE CASING	2.2	4447.7
TOP OF SEAL	59.0	4390.9
TOP OF FILTER PACK	69.0	4380.9
TOP OF SCREEN	76.5	4373.4
BOTTOM OF SCREEN	86.5	4363.4
BOTTOM OF SUMP	89.0	4360.9
BOTTOM OF HOLE	89.0	4360.9

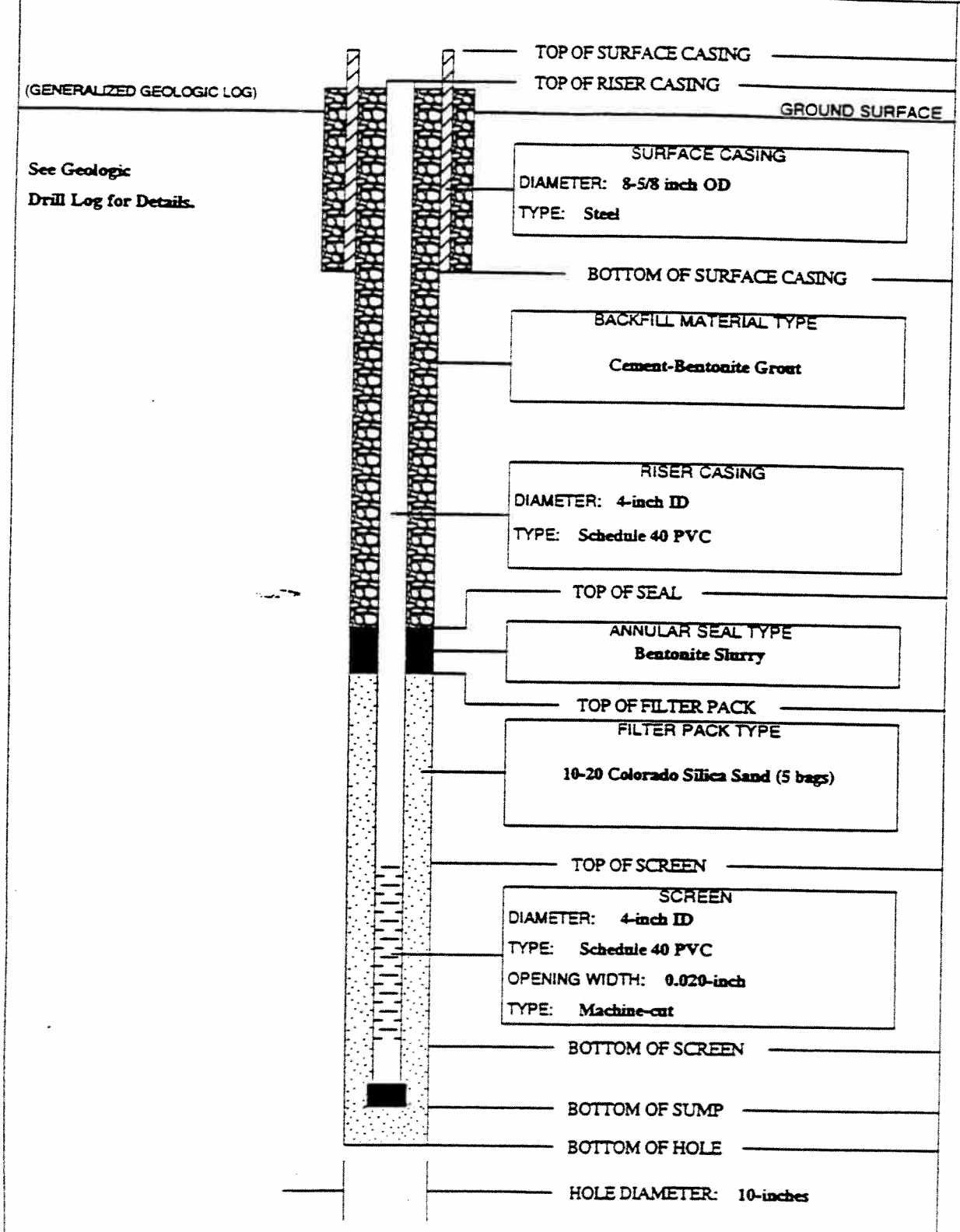
NOT TO SCALE

MONITORING WELL

PROJECT	WELL NO.
EMF POCATELLO, ID	172

JOB NO.	SITE	COORDINATES and / or STATIONING
20906	FMC Pond 17	N 449,271.6 : E 551,080.8

BEGUN	COMPLETED	PREPARED BY	REFERENCE POINT FOR MEASUREMENTS
7-15-97	7-15-97	Dave Kyllonen	Top of PVC Casing-Water Levels



	DEPTH (FT)	ELEV. (FTMSL)
TOP OF SURFACE CASING	-2.9	4450.8
TOP OF RISER CASING	-2.7	4450.57
GROUND SURFACE	0.0	4447.9
BOTTOM OF SURFACE CASING	2.2	4445.7
TOP OF SEAL	61.0	4386.9
TOP OF FILTER PACK	69.0	4378.9
TOP OF SCREEN	71.0	4376.9
BOTTOM OF SCREEN	76.0	4371.9
BOTTOM OF SUMP	79.0	4368.9
BOTTOM OF HOLE	79.5	4368.4

NOT TO SCALE

MONITORING WELL

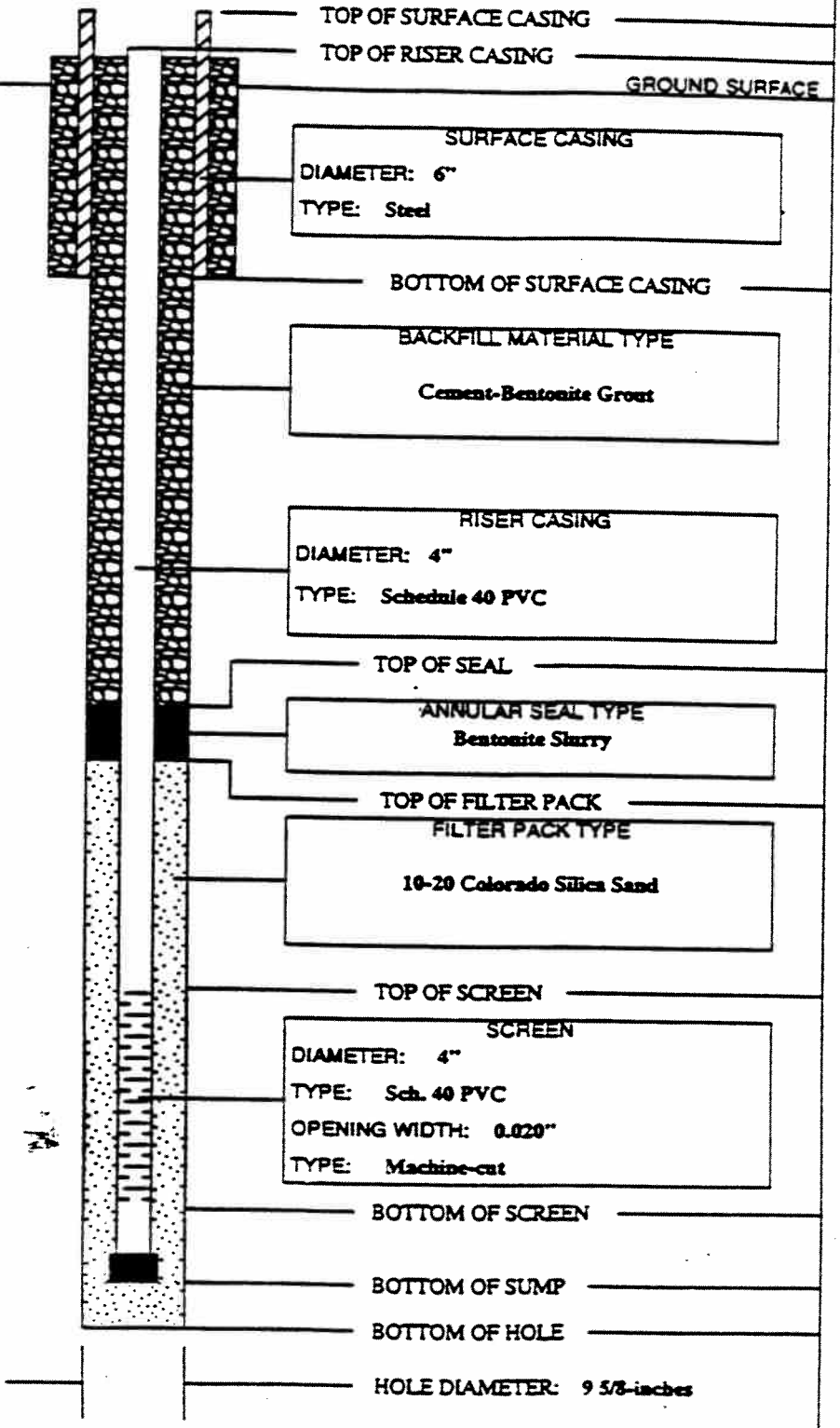
JOB NO.	SITE	COORDINATES and / or STATIONING	WELL NO.
[illegible]006	FMC Pond 17	N 449,231.3 : E 550,171.8	173
STARTED	**COMPLETED**	**PREPARED BY**	**REFERENCE POINT FOR MEASUREMENTS**
[illegible]0-16-98	10-16-98	L. R. West	Top of PVC Casing-Water Levels

PROJECT: EMF POCATELLO, ID

(GENERALIZED GEOLOGIC LOG)

See Geologic Drill Log for Details.

NOT TO SCALE



	DEPTH (FT)	ELEV. (FTMSL)
TOP OF SURFACE CASING	-3	4452.76
TOP OF RISER CASING	-2.8	4452.58
GROUND SURFACE	0.0	4449.8
BOTTOM OF SURFACE CASING	2.0	4447.8
TOP OF SEAL	55.0	4394.8
TOP OF FILTER PACK	65.4	4384.4
TOP OF SCREEN	70.0	4379.8
BOTTOM OF SCREEN	85.0	4364.8
BOTTOM OF SUMP	87.8	4361.9
BOTTOM OF HOLE	89.0	4360.8

Update: Nov 12, 1998
Report Form: EMF-WELLOG2

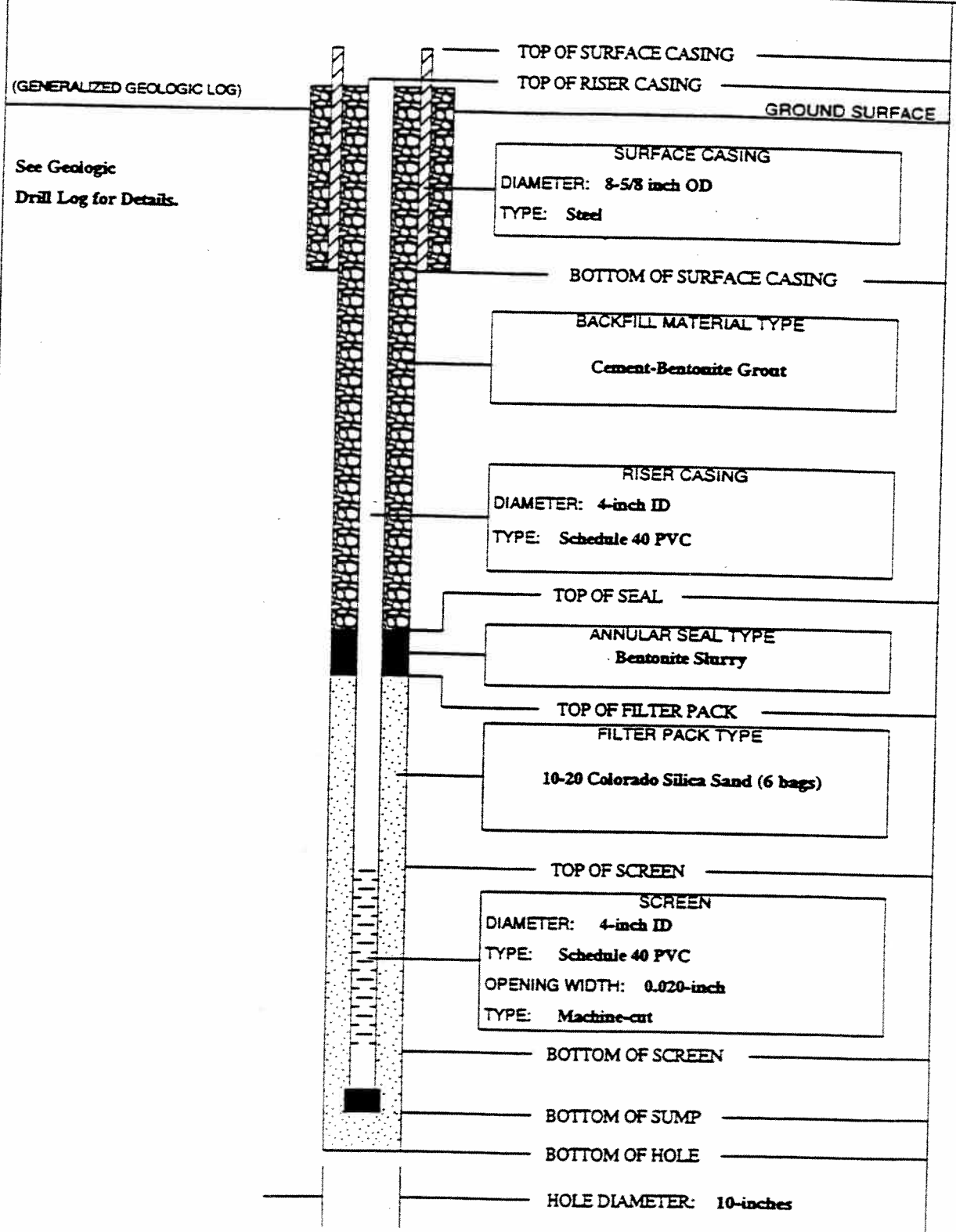
NOT TO SCALE

MONITORING WELL

PROJECT	WELL NO.
EMF POCATELLO, ID	180

JOB NO.	SITE	COORDINATES and / or STATIONING
20906	FMC Pond 17	N 449,088.4 : E 550,976.2

BEGUN	COMPLETED	PREPARED BY	REFERENCE POINT FOR MEASUREMENTS
7-16-97	7-16-97	Dave Kyllonen	Top of PVC Casing-Water Levels



	DEPTH (FT)	ELEV. (FTMSL)
TOP OF SURFACE CASING	-3	4453.1
TOP OF RISER CASING	-2.7	4452.77
GROUND SURFACE	0.0	4450.1
BOTTOM OF SURFACE CASING	2.1	4448.0
TOP OF SEAL	40.0	4410.1
TOP OF FILTER PACK	48.7	4401.4
TOP OF SCREEN	52.2	4397.9
BOTTOM OF SCREEN	62.2	4387.9
BOTTOM OF SUMP	65.2	4384.9
BOTTOM OF HOLE	65.5	4384.6

NOT TO SCALE

WMU # 15 (POND 18)

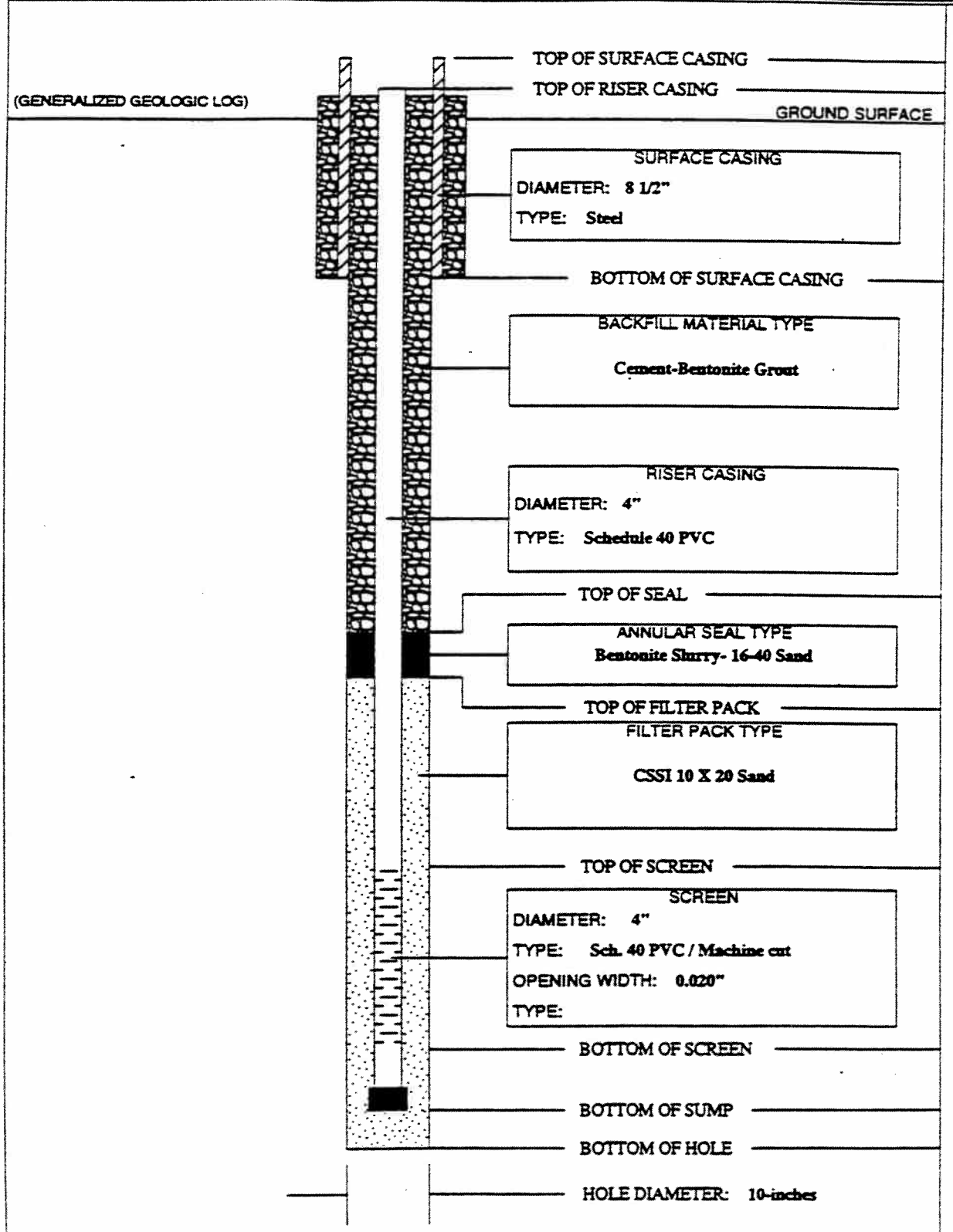
WELL COMPLETION DIAGRAMS

MONITORING WELL

PROJECT	WELL NO.
EMF POCATELLO, ID	154

JOB NO.	SITE	COORDINATES and / or STATIONING
20906	FMC Corporation	N 449,702.0 : E 550,197.8

BEGUN	COMPLETED	PREPARED BY	REFERENCE POINT FOR MEASUREMENTS
11-2-92	11-2-92	G. Day	Top of PVC Casing-Water Level



	DEPTH (FT)	ELEV. (FTMSL)
TOP OF SURFACE CASING	-2.3	4447.6
TOP OF RISER CASING	-1.7	4447
GROUND SURFACE	0.0	4445.3
BOTTOM OF SURFACE CASING	2.7	4442.6
TOP OF SEAL	63.0	4382.3
TOP OF FILTER PACK	68.0	4377.3
TOP OF SCREEN	73.6	4371.7
BOTTOM OF SCREEN	77.8	4367.5
BOTTOM OF SUMP	81.1	4364.2
BOTTOM OF HOLE	83.0	4362.3

NOT TO SCALE

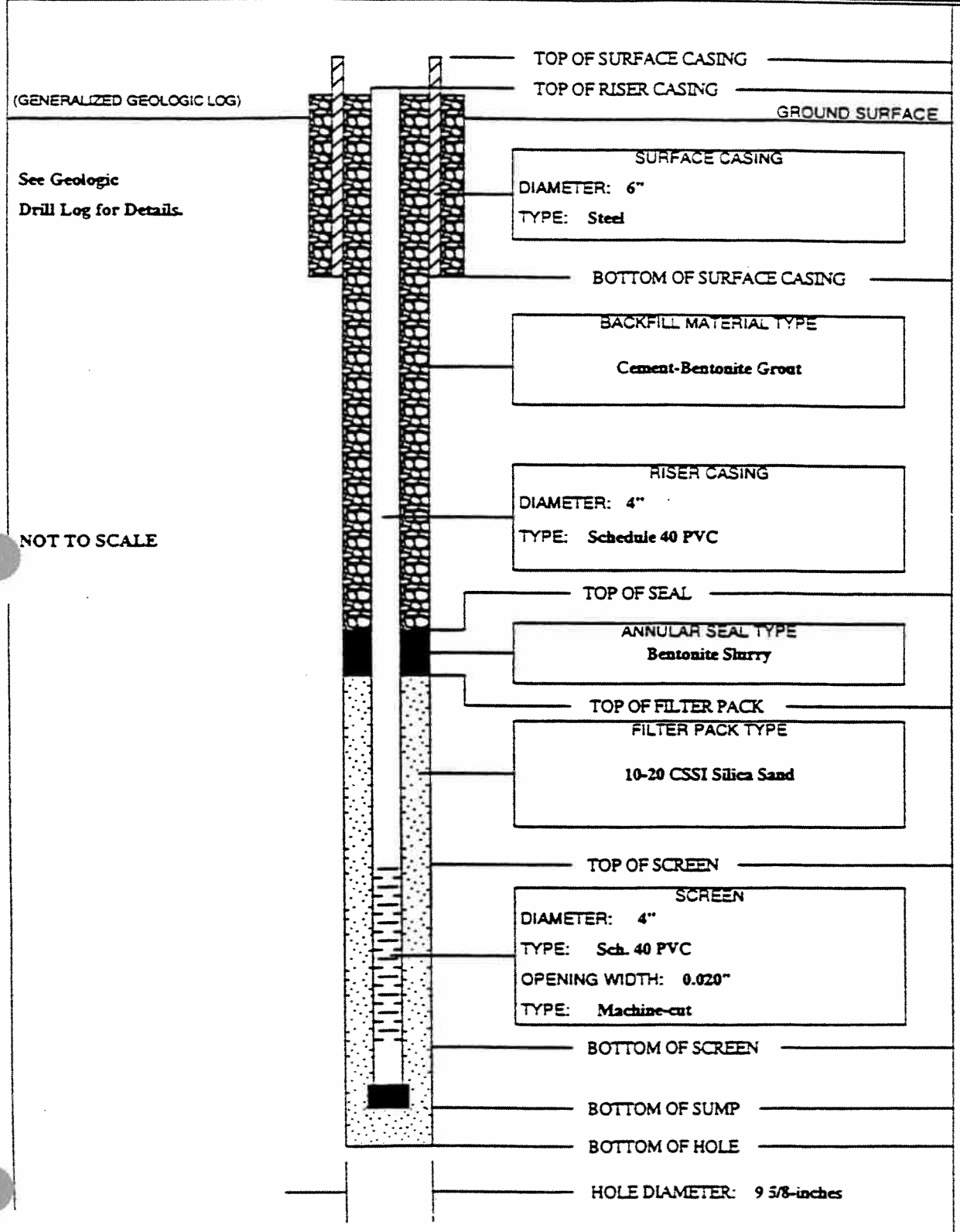
Update: Oct 13, 1997
Report Form: EMF-WELLOG2

MONITORING WELL

PROJECT	WELL NO.
EMF POCATELLO, ID	174

JOB NO.	SITE	COORDINATES and / or STATIONING
20906	FMC Pond 18	N 449,232.7 : E 549,303.4

BEGUN	COMPLETED	PREPARED BY	REFERENCE POINT FOR MEASUREMENTS
10-15-98	10-15-98	L. R. West	Top of PVC Casing-Water Levels



	DEPTH (FT)	ELEV. (FTMSL)
TOP OF SURFACE CASING	-3	4447.12
TOP OF RISER CASING	-2.8	4446.92
GROUND SURFACE	0.0	4444.1
BOTTOM OF SURFACE CASING	2.0	4442.1
TOP OF SEAL	60.0	4384.1
TOP OF FILTER PACK	70.1	4374.0
TOP OF SCREEN	75.0	4369.1
BOTTOM OF SCREEN	85.0	4359.1
BOTTOM OF SUMP	87.9	4356.2
BOTTOM OF HOLE	88.0	4356.1

Update: Nov 12, 1998
Report Form: EMF-WELLOG2

NOT TO SCALE

MONITORING WELL

JOB NO.	SITE	COORDINATES and / or STATIONING	WELL NO.
06	FMC Pond 18	N 450,022.2 : E 550,106.4	177

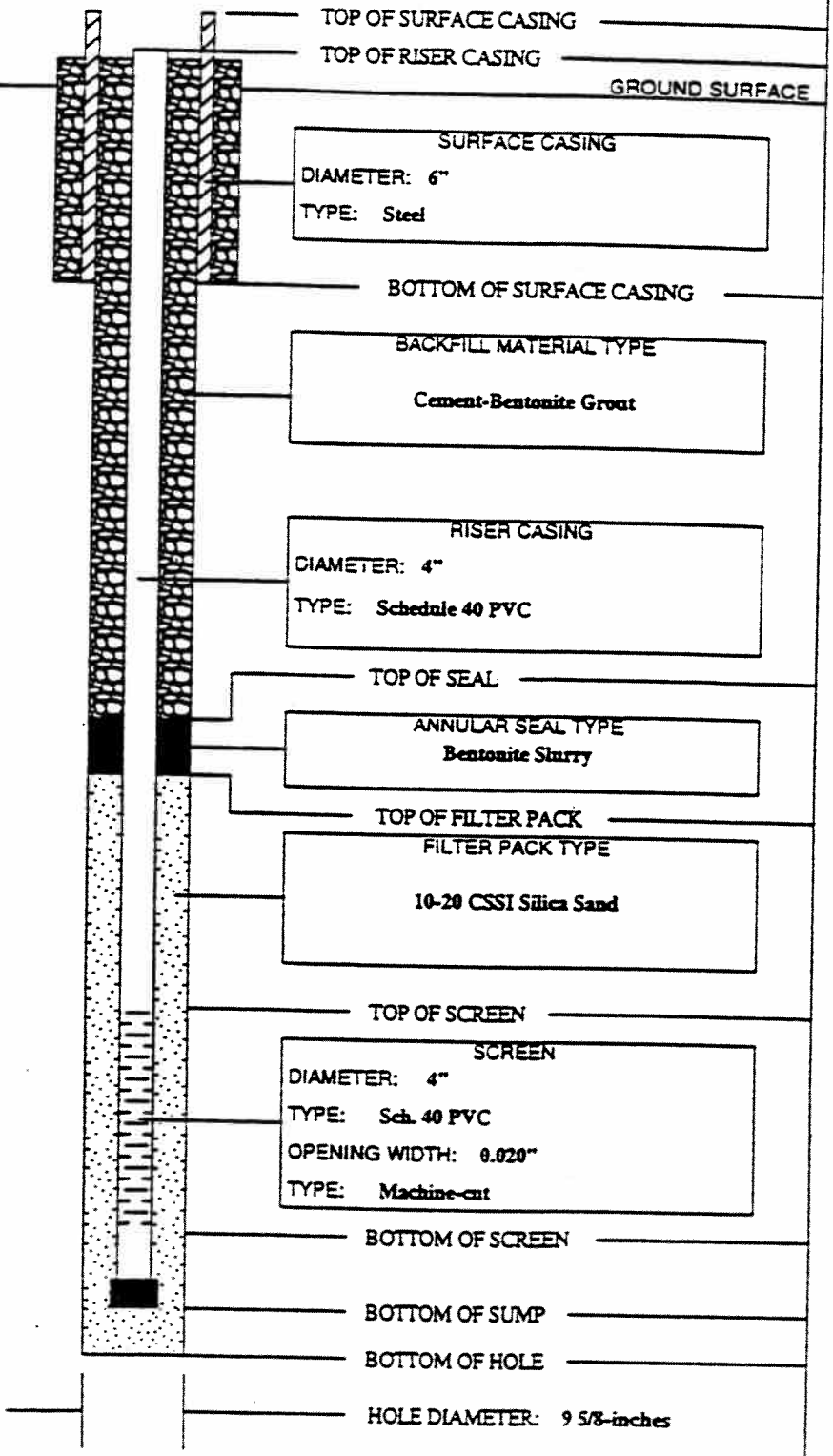
COMPLETED	PREPARED BY	REFERENCE POINT FOR MEASUREMENTS
10-13-98	L. R. West	Top of PVC Casing-Water Levels

PROJECT: EMF POCATELLO, ID

(GENERALIZED GEOLOGIC LOG)

See Geologic Drill Log for Details.

TO SCALE



	DEPTH (FT)	ELEV. (FTMSL)
TOP OF SURFACE CASING	-3	4444.95
TOP OF RISER CASING	-2.7	4444.61
GROUND SURFACE	0.0	4442.0
BOTTOM OF SURFACE CASING	2.0	4440.0
TOP OF SEAL	61.4	4380.6
TOP OF FILTER PACK	71.4	4370.6
TOP OF SCREEN	75.1	4366.9
BOTTOM OF SCREEN	85.1	4356.9
BOTTOM OF SUMP	88.0	4354.0
BOTTOM OF HOLE	88.4	4353.6

NOT TO SCALE

MONITORING WELL

PROJECT	WELL NO.
EMF POCATELLO, ID	178

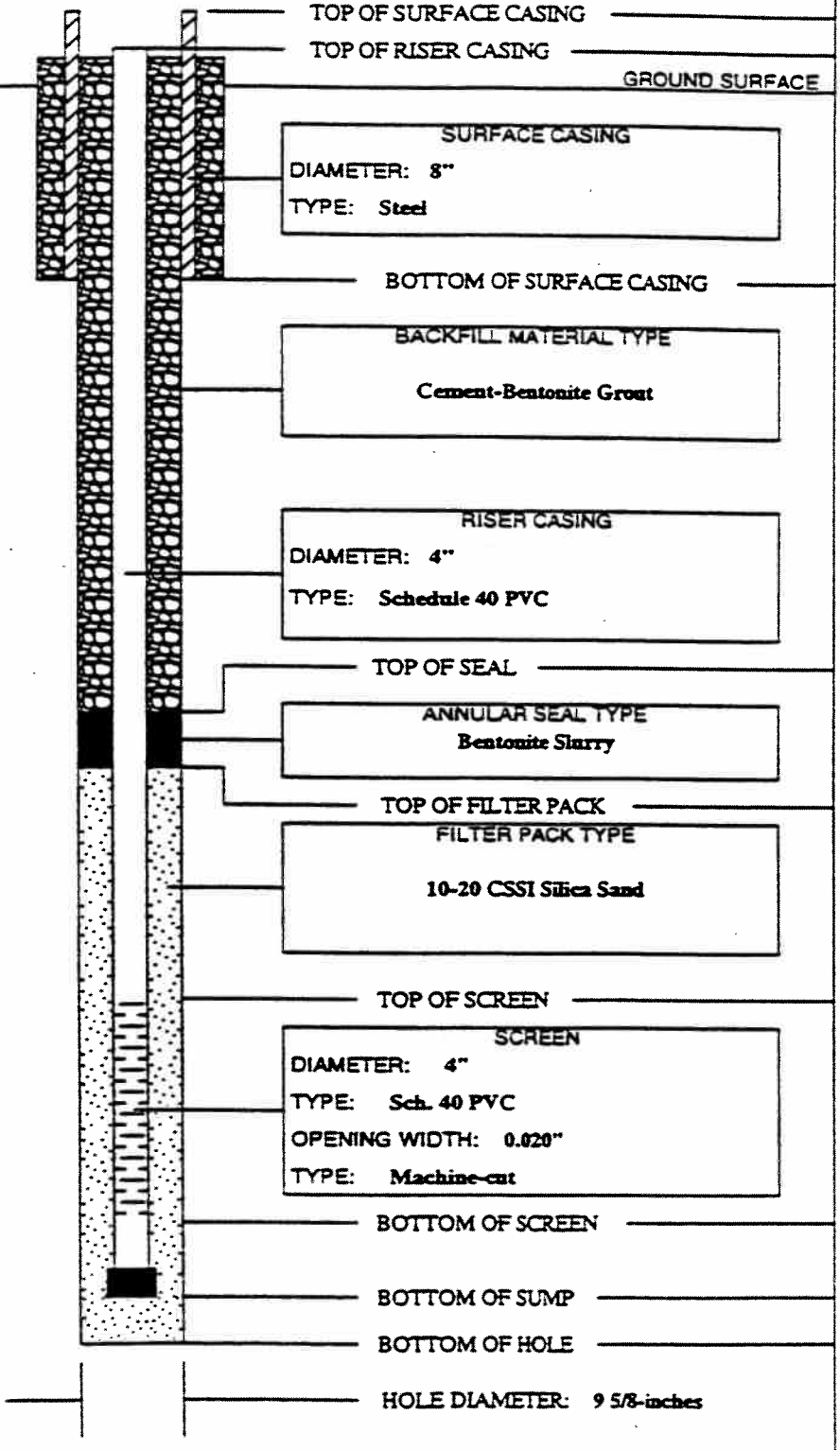
JOB NO.	SITE	COORDINATES and / or STATIONING
20906	FMC Pond 18	N 449,473.9 : E 550,275.2

GUN	COMPLETED	PREPARED BY	REFERENCE POINT FOR MEASUREMENTS
10-12-98	10-13-98	L. R. West	Top of PVC Casing-Water Levels

(GENERALIZED GEOLOGIC LOG)

See Geologic Drill Log for Details.

NOT TO SCALE



	DEPTH (FT)	ELEV. (FTMSL)
TOP OF SURFACE CASING	-3	4451.47
TOP OF RISER CASING	-2.7	4451.14
GROUND SURFACE	0.0	4448.5
BOTTOM OF SURFACE CASING	2.0	4446.5
TOP OF SEAL	46.0	4402.5
TOP OF FILTER PACK	56.4	4392.1
TOP OF SCREEN	60.0	4388.5
BOTTOM OF SCREEN	75.0	4373.5
BOTTOM OF SUMP	77.8	4370.7
BOTTOM OF HOLE	78.5	4370.0

NOT TO SCALE

APPENDIX A-3

Field Sampling Plan

for

RCRA Pond Cap Integrity Monitoring

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TABLES

1.0 INTRODUCTION

This field sampling plan (FSP) implements the quality control requirements for RCRA post-closure monitoring for the RCRA ponds as specified in the *RCRA Quality Assurance Project Plan* (QAPP). This FSP and the associated QAPP constitute the RCRA sampling and analysis plan (SAP) for the following RCRA pond post-closure activities:

- Vegetation cover monitoring on the RCRA pond cap surface;
- Settlement monitoring of the RCRA pond cap;
- Topsoil depth monitoring on the RCRA pond cap;
- Rodent/insect impact monitoring on the RCRA pond cap;
- ET cap drainage monitoring;
- RCRA pond LCDRS collection monitoring;
- Stormwater/snowmelt run-off erosion monitoring;
- Survey benchmark monitoring;
- Security system monitoring;
- TMP enclosures and perimeter piping standpipe monitoring; and
- Inspection of the Pond 16S cap road.

Note that a separate FSP has been prepared for groundwater monitoring as presented in Appendix A-2 of the *RCRA Post-Closure Plan.*

1.1 BACKGROUND

Throughout the operational history of the FMC Plant Site (EPA ID #IDD070929518), a series of surface impoundments (ponds) were constructed and placed into service to manage wastewater from the manufacturing process. The two primary wastewater streams from the phosphorus production process, phossy water and precipitator slurry, were routed to ponds to settle entrained solids and clarify the wastewater for recycle/reuse in the process. During plant operation from 1954 through 1989, numerous ponds were constructed, used for wastewater management, filled with process solids, and subsequently taken out of service and covered with plant fill materials. These ponds, which had ceased receiving wastes prior to the narrowing of the Bevill exemption and were thus not subject to RCRA regulation, are currently being addressed as part of the FMC Plant OU supplemental remedial investigation/supplemental feasibility study (SRI/SFS). However, a number of lined ponds were still in service (i.e., maintaining a hydraulic head of water) at the time RCRA regulation became applicable to these ponds (i.e., narrowing of the Bevill exemption in March 1990). As FMC had determined that the solids associated with these wastewater streams could exhibit the RCRA toxicity characteristic for cadmium, the ponds became subject to RCRA interim status. These ponds included:

- Pond 8E
- Pond 9E
- Pond 8S
- Phase IV Ponds (Including Ponds 11S, 12S, 13S, and 14S) and
- Pond 15S

After these ponds became subject to RCRA regulation, four additional lined ponds were constructed to manage the phossy water and/or precipitator slurry wastewater streams, including:

- Pond 16S
- Pond 17
- Pond 18 Cell A
- Pond 18 Cell B

A *RCRA Consent Decree* (*RCRA CD*) entered on July 13, 1999, required FMC, among other things, to close and cap these RCRA-regulated ponds in accordance with all applicable RCRA requirements, including in accordance with EPA-approved closure plans and a closure schedule specified in the *RCRA CD*. Final closure has been certified by EPA for all of these ponds. Wastes were left in place for all of these ponds, with the exception of Pond 18 Cell B that was closed by removal of all wastes. Section 10 of the individual closure plans for each of these RCRA-regulated ponds included the post-closure plan for that particular pond. These EPA-approved closure plans were very similar, although some differences in the original construction of the ponds and the pond closure cover systems resulted in differing post-closure requirements. Note that Pond 18 Cell B did not have a post-closure plan as it was closed by complete removal of all wastes and constituents.

1.2 PREVIOUS RESULTS

The purpose of this subsection is to present information on historical post-closure monitoring experience that would support modification to some post-closure monitoring while maintaining others. The final cap was placed on Pond 8S in 1999 with the *Pond 8S Post Closure Plan* being approved in August 1998. The other RCRA ponds were closed with final cap through 2005 (as shown in Table 1.0), each with EPA-approved closure and post-closure plans. Therefore, with over 10 years of post-closure monitoring experience on the RCRA ponds, extensive experience has been used in the development of post-closure monitoring as included in the *RCRA Pond Post-Closure Plans*, the *QAPP*, and this *FSP*. Note that historical monitoring that supports the development of this *FSP* includes the following RCRA pond monitoring procedures:

- Vegetation cover monitoring on the RCRA pond cap surface;
- Settlement monitoring of the RCRA pond cap;

- Topsoil depth monitoring on the RCRA pond cap;
- Rodent/insect impact monitoring on the RCRA pond cap;
- ET cap drainage monitoring;
- RCRA pond LCDRS collection monitoring;
- Stormwater/snowmelt run-off erosion monitoring;
- Survey benchmark monitoring;
- Security system monitoring; and
- Pond 16S cap road monitoring.

A separate *FSP* (included in Appendix A-2 of the *Post-Closure Plan*) covers the RCRA pond groundwater monitoring. The following subsections provide a rationale for continued post-closure monitoring based upon historic monitoring experience, the DQOs (as presented in Section 1.4 of the *QAPP*), and the regulatory requirements.

1.2.1 CAP INTEGRITY MONITORING

Several post-closure monitoring activities have been historically conducted to perform cap integrity post-closure monitoring as discussed below:

Surface Vegetation Monitoring – The objective of the RCRA cap vegetation monitoring is to inspect the vegetation cover on the RCRA cap surface to ensure that significant areas do not become void of vegetation. To meet the vegetation monitoring objective, the RCRA pond caps have been visually inspected at least semiannually at the height of the growing season and in the fall to determine if "bare spots" in the vegetation are developing. This was consistent with the provisions of the original post-closure plans developed and approved for each RCRA pond. During a RCRA site visit on November 10-11, 2008, an EPA contractor, Booz Allen Hamilton, reviewed all aspects of the FMC Pocatello RCRA post-closure activities. The subsequent report recommended, *"The post-closure plans for all ponds should be modified to more specifically define "adequate grass coverage" on the caps and the conditions that trigger repair/reseeding actions"* (BAH, 2008). As result of this recommendation, more specific information on the surface vegetation monitoring procedure has been developed for the vegetation monitoring field activities as presented in Section 4.3.1 of this *FSP*.

Settlement monitoring – The objective of the cap settlement monitoring is to determine if excessive settlement or movement of pond cap materials of construction is taking place. To meet the settlement monitoring objective, annual vertical and horizontal displacement measurements have been historically made of settlement monuments constructed within the RCRA pond cap. The previous results of post-closure settlement monitoring appear to be meeting the DQOs and regulatory requirements. Therefore, no change in monitoring schedule or procedures has been made. However, in comments submitted by EPA on June 18, 2010 on a *Draft Pond 16S Post-Closure Plan* modification, EPA stated that: "The PC Plan must specify the magnitude/distance of the seismic event." The procedures for the settlement monitoring field activities, as modified to specify the magnitude/distance of the seismic event are presented in Section 4.3.2 of the *FSP*.

Topsoil Depth Monitoring - The objective of the cap topsoil depth monitoring is to determine if wind and/or water erosion has removed or re-distributed topsoil to the extent that the ET cap design capabilities are diminished. Topsoil depth monitoring is only performed on ponds with a "RCRA double cap", i.e., are equipped with an ET cap (as installed on RCRA Ponds 8S, Phase IV, 15S, and 18 Cell A). To meet the topsoil depth monitoring objective, semiannual measurements of topsoil depth historically have been made against several topsoil depth indicators constructed within the RCRA pond cap. The previous results of post-closure topsoil depth monitoring appear to be meeting the DQOs and regulatory requirements. Therefore, no change in monitoring schedule or procedures has been made. However, in comments submitted by EPA on June 18, 2010 on a *Draft Pond 16S Post-Closure Plan* modification, EPA requested that additional topsoil depth monitoring be performed in the event of a triggering wind event. The procedures for the topsoil depth monitoring field activities, as modified to address a triggering wind event, are presented in Section 4.3.3 of this *FSP*.

Rodent/Insect Infestation Monitoring – The objective of the RCRA cap rodent/insect infestation monitoring is to inspect the RCRA cap surface to identify evidence of rodent burrowing or loss of vegetation from rodent or insect feeding. To meet the rodent/insect infestation monitoring objective, the RCRA pond caps historically have been visually inspected at least semiannually to determine if evidence of rodent burrowing or loss of vegetation has occurred. This is consistent with the provisions of the original post-closure plans developed and approved for each RCRA pond. Inspections have been performed during the late spring (typically in June) and again in the fall (typically in September when burrowing rodents and insect activity have declined). The previous results of post-closure rodent/insect infestation monitoring appear to be meeting the DQOs and regulatory requirements. Therefore, no change in procedures has been made. The procedures for the rodent/insect monitoring field activities are presented in Section 4.3.4 of this *FSP*.

ET Cap Drainage Monitoring - RCRA ponds that are equipped with a "RCRA double cap" incorporate an ET cap (as installed on RCRA Ponds 8S, Phase IV, 15S, 16S, and 18 Cell A). A properly functioning ET cap should store precipitation water in the storage layer, to later dissipate the stored water through evapotranspiration. The ET cap is equipped with a drainage layer underneath the storage layer. Precipitation that percolates through the storage layer to the drainage layer will pass through a piping system to be accumulated in the ET cap drainage accumulation sump. Accumulation of ET cap drainage water in excess of design rates may indicate the ET cap is not functioning properly. The objective of the ET drainage monitoring is to determine and record the annual volume of water accumulated from the ET cap drainage layer. Each of these ponds is equipped with one or more ET cap drainage collection sumps. To meet the ET cap drainage monitoring objective, these collection sumps historically have been inspected annually with ET cap drainage accumulation volumes being determined and compared to predicted normal drainage rates. This is consistent with the provisions of the original post-closure plans developed and approved for each RCRA pond. Inspections have typically been performed in the fourth quarter of the year.

Throughout the history of monitoring ET cap drainage at all the RCRA ponds, errors in ET cap drainage volume collection have been noted as a result of the following:

- Failure of the totalizer which indicates a volume of cap drainage water has been pumped when the pump was not activated; and

- Infiltration of stormwater into the cap drainage accumulation tank other than water percolating through the ET cap.

Accordingly, maintenance of the cap drainage systems has been completed, where appropriate, and a simple cap drainage water pumping/measurement system has been included in the cap drainage monitoring procedures. In addition, in comments submitted by EPA on June 18, 2010 on a *Draft Pond 16S Post-Closure Plan* modification, EPA requested that language be inserted that "EPA approval would be required and that EPA would be notified within one week of a finding that the cap needs to be re-designed" based upon ET cap drainage monitoring. The procedures for the ET cap drainage monitoring field activities, including provisions for notifying EPA and seeking approval if the ET cap needs to be re-designed, are presented in Section 4.3.5 of this *FSP*.

1.2.2 LCDRS MONITORING

Six of the RCRA ponds (Ponds 8E, 9E, 15S, 16S, 17, and 18 Cell A) were designed and installed with double liners and an associated leachate collection, detection and removal system (LCDRS). The objective of the LCDRS monitoring is to determine and record the volume and rate of leachate collected at each RCRA pond. Each of these ponds is equipped with one or more leachate collection sumps. To meet the LCDRS monitoring objective, these LCDRS sumps historically have been inspected on a progressive step-wise schedule per 40 CFR § 265.226(b)(2) and leachate accumulation volumes pumped, measured, and recorded as necessary. The previous results of post-closure LCDRS monitoring appear to be meeting the DQOs and regulatory requirements. However, in comments submitted by EPA on June 18, 2010 on a *Draft Pond 16S Post-Closure Plan* modification, EPA requested that accumulated leachate be analyzed for pH in addition to metals. Therefore, no change in procedures has been made except to include measurement of pH of the leachate. The procedures for the LCDRS monitoring field activities are presented in Section 4.4 of this *FSP*.

1.2.3 RCRA POND RUN-OFF EROSION MONITORING

The objective of the RCRA Pond cap run-on and/or run-off erosion monitoring is to determine if water erosion from run-on or run-off has removed or re-distributed topsoil to the extent that the ET cap design capabilities may be impaired. In addition, stormwater/snowmelt diversionary/accumulation systems are inspected to note and remove debris, sediment, or other obstructions. To meet the stormwater/snowmelt monitoring objective, the RCRA pond caps historically have been visually inspected semiannually and within 48 hours of a 25-year, 24-hour storm event, to determine if cap surface erosion or ponding has occurred. Diversionary/accumulation structures are also inspected for accumulation of debris or sediment and erosion damage. The previous results of post-closure stormwater/snowmelt runoff monitoring appear to be meeting the DQOs and regulatory requirements. However, in comments submitted by EPA on June 18, 2010 on a *Draft Pond 16S Post-Closure Plan* modification, EPA requested that: 1) the amount of precipitation that would trigger an additional inspection be specified, and 2) a rain-on-snow event would also trigger an additional inspection. Therefore, no change in monitoring schedule or procedures has been made except to specify the precipitation events that would trigger additional

monitoring. The procedures for the stormwater/snowmelt monitoring field activities are presented in Section 4.5 of this *FSP*.

1.2.4 SURVEY BENCHMARK MONITORING

The objective of the survey benchmark monitoring is to ensure that the survey benchmarks used to determine the exact location and dimensions of RCRA ponds and to perform the settlement monitoring are properly protected and maintained. To meet the survey benchmark monitoring objective, survey benchmark associated with the RCRA ponds historically have been monitored annually in conjunction with the settlement monument monitoring. The previous results of post-closure survey benchmark monitoring appear to be meeting the DQOs and regulatory requirements. Therefore, no change in monitoring schedule or procedures has been made. The procedures for the survey benchmark monitoring field activities are presented in Section 4.6 of this *FSP*.

1.2.5 RCRA POND SECURITY MONITORING

The objective of the security system monitoring is to ensure that security systems are in place, functional, and maintained. Security systems for the RCRA ponds include fencing, secured gates, and warning signs. Monitoring of security systems has been conducted at least semiannually to ensure all security systems are in place and functioning as designed. The previous results of post-closure security monitoring appear to be meeting the DQOs and regulatory requirements. Therefore, no change in monitoring schedule or procedures is recommended. The procedures for the security monitoring field activities are presented in Section 4.6 of this *FSP*.

1.2.6 POND 16S CAP ROAD MONITORING

The objective of the Pond 16S cap road monitoring is to determine if the presence of the cap road creates additional water erosion from run-on or run-off and/or if topsoil is being removed or re-distributed to the extent that the Pond 16S ET cap design capabilities may be impaired. The previous results of Pond 16S cap road monitoring appear to be meeting the DQOs and regulatory requirements. Therefore, no changes in monitoring procedures is recommended. The procedures for the Pond 16S cap road monitoring field activities are presented in Section 4.7 of this *FSP*.

2.0 MONITORING OBJECTIVES

The Data Quality Objectives (DQOs) have been developed for the RCRA pond post-closure monitoring as presented in the original *FMC RCRA QAPP* (Appendix A-1 of the *RCRA Pond Post-Closure Plans*). These DQOs for the RCRA pond post-closure monitoring have been updated and expanded to address all post-closure monitoring activities. The following presents a discussion on the overall post-closure monitoring objectives upon which the amended DQOs are based.

2.1 MAINTAINING THE INTEGRITY AND EFFECTIVENESS OF THE FINAL COVER

The post-closure performance standards for maintaining the integrity and effectiveness of the final cover are set forth in 40 CFR §265.228(b)(1) and §265.310(b)(1). These state that during the post-closure care period, the owner or operator must "*Maintain the integrity and effectiveness of the final cover, including making repairs to the cover as necessary to correct effects of settling, subsidence, erosion, or other events.*" The following describes the post-closure actions that FMC will take to ensure that this performance standard is being met.

- Collecting sufficient data and information to determine if the pond cover system is being maintained such that the cap is capable of performing as designed, i.e., limiting infiltration of precipitation into the wastes within the pond and taking corrective action when deficiencies are noted. The specific actions to meet these objectives consist of the following:
    - Surface vegetation monitoring;
    - Settlement monitoring;
    - Topsoil depth monitoring;
    - Rodent/insect infestation monitoring;
    - ET cap drainage monitoring; and
    - Maintenance or repair as needed to comply with the performance standard based on the monitoring.

The DQOs associated with the maintaining the integrity and effectiveness of the final cover on the RCRA ponds are presented in Table 1.1 of the *RCRA Pond QAPP* (see Appendix A-1 of the *RCRA Pond Post-Closure Plan*).

2.2 MAINTAINING AND MONITORING THE LEAK DETECTION SYSTEM

The post-closure performance standards for maintaining and monitoring the leak detection system are provided in 40 CFR §265.228(b)(2) and §265.310(b)(2) which state that during the post-closure care period, the owner or operator must "*Maintain and monitor the leak detection system … and comply with all other applicable leak detection system requirements.*" The following describes the post-closure actions that FMC will take to ensure that this performance standard is being met.

- Ensuring that the LCDRS is properly maintained, including being pumped to minimize the head on the bottom liner, by collecting sufficient data and information to determine and record the amount of liquids being pumped from the system, and taking corrective action when deficiencies are noted. The specific actions to meet these objectives consist of the following:
    - Inspections of the LCDRS system;
    - Pumping of the LCDRS when liquid levels reach the invert of the inlet pipe to the LCDRS sump;
    - Measuring and recording the amount of liquid pumped from the LCDRS;
    - Performing waste determination per 40 CFR §262.11 and proper disposal of pumped leachate; and
    - Maintenance or repair as needed to comply with the performance standard based on the inspections

The DQOs associated with the maintaining and monitoring the LCDRS on the RCRA ponds are presented in Table 1.2 of the *RCRA Pond QAPP* (see Appendix A-1 of the *RCRA Pond Post-Closure Plan*).

2.3 PREVENTION OF RUN-OFF EROSION OR OTHER DAMAGE TO THE FINAL COVER

The post-closure performance standards for prevention of final cover damage from run-on and/or run-off are provided in 40 CFR §265.228(b)(4) and §265.310(b)(4) which state that during the post-closure care period, the owner or operator must "*Prevent run-on and run-off from eroding or otherwise damaging the final cover.*" The following describes the post-closure actions that FMC will take to ensure that this performance standard is being met.

- Inspecting and maintaining the cap surface and stormwater/snowmelt diversion structures (drainage ditches) to minimize cap surface erosion or other damage, and taking corrective action when deficiencies are noted. The specific actions to meet these objectives consist of the following:
    - Inspections of the cap surface for signs of erosion or ponding of stormwater/snowmelt;
    - Inspections of stormwater/snowmelt diversionary structures for accumulation of debris or sediment and/or damage; and
    - Maintenance or repair as needed to comply with the performance standard based on the inspections.

The DQOs associated with the run-off erosion of the final cover on the RCRA ponds are presented in Table 1.3 of the *RCRA Pond QAPP* (see Appendix A-1 of the *RCRA Pond Post-Closure Plan*).

2.4 PROTECTION AND MAINTENANCE OF BENCHMARKS

The post-closure performance standards for protection and maintenance of benchmarks are provided in 40 CFR §265.310(b)(5) which state that during the post-closure care period, the

owner or operator must "*Protect and maintain surveyed benchmarks used in complying with §265.309.*" The following describes the post-closure actions that FMC will take to ensure that this performance standard is being met.

- Inspecting and maintaining the benchmarks used to survey RCRA pond location and dimensions and settlement monument movement, and taking corrective action when deficiencies are noted. The specific actions to meet these objectives consist of the following:
    - Inspections of the survey benchmark control stations "94-1" and "94-4"; and
    - Maintenance or repair as needed to comply with the performance standard based on the inspections.

The DQOs associated with protection and maintenance of benchmarks used for surveying at the RCRA ponds are presented in Table 1.3 of the *RCRA Pond QAPP* (see Appendix A-1 of the *RCRA Pond Post-Closure Plan*).

2.5 MAINTENANCE OF SECURITY SYSTEMS

40 CFR §265.14(a) requires the owner or operator must prevent the unknowing entry, and minimize the possibility of the unauthorized entry, of persons or livestock onto the active portion of the facility. The RCRA ponds area is wholly enclosed within the boundaries of the FMC plant site which has a combination of fencing around the property boundary, natural barriers and controlled entry. Access to the closed unit is and will be controlled to protect the cover, benchmarks, and monitoring systems from inadvertent access of unauthorized persons. The overall post-closure monitoring objective to demonstrate this performance standard is being met is as follows:

- Inspecting and maintaining all RCRA pond security systems, including fencing, gates, and signs. Also, to take corrective action when deficiencies are noted. This overall monitoring objective is to be demonstrated through the following monitoring activities:
    - Inspections of the RCRA pond fencing, gates, and signs.
    - Maintenance or repair as needed to comply with the performance standard based on the inspections.

The DQOs associated with maintenance of the RCRA pond security systems are presented in Table 1.3 of the *RCRA Pond QAPP* (see Appendix A-1 of the *RCRA Pond Post-Closure Plan*).

3.0 MONITORING LOCATIONS AND FREQUENCY

The RCRA pond cap monitoring locations and frequency are summarized in Table 2.1 of the *RCRA Pond Post-Closure Plan* and discussed in the subsections below.

3.1 CAP INTEGRITY MONITORING

The cap integrity post-closure monitoring locations and frequencies for each activity are discussed below:

Surface Vegetation Monitoring –For each of the RCRA ponds, surface vegetation will be monitored on an annual basis (typically in September) over the areal extent of the pond cap surface. The cap vegetation inspections will be summarized in the *RCRA Pond Annual Post-Closure Report*. Any areas of the RCRA pond caps that require maintenance or re-vegetation will be noted on the inspection form.

Settlement monitoring – For all of the RCRA ponds, settlement monitoring will be performed (1) annually until the total cumulative movements for the previous five years are less than the following limits:

- Vertical settlement: 0.03 foot
- Horizontal movement: 0.2 foot

and then every five years during the post-closure period after the above limits are reached; (2) if visible subsidence is noted during semiannual run-on and/or run-off erosion monitoring or other monitoring and/or maintenance; and (3) after local seismic events. The criteria for visible subsidence requiring settlement monitoring has been established as an area of 100 square feet (a 10 foot by 10 foot or 11 foot diameter area) or greater where precipitation ponding is observed or could occur to a depth of 1 inch of water or greater. A triggering seismic event is defined as an event that (1) exceeds a magnitude 5.0 on the Richter Scale with an epicenter within a 20-mile radius as reported by USGS or (2) exceeds a magnitude 6.0 on the Richter Scale with an epicenter within a 50-mile radius as reported by USGS. Settlement monitoring will be based on control stations “94-1” and “94-4,” which are local stations in FMC’s survey control system. The RCRA ponds are equipped with the following number of settlement monuments:

- Pond 8E has 5 settlement monuments;
- Pond 9E has 8 settlement monuments;
- Pond 8S has 5 settlement monuments;
- Phase IV Ponds have 17 settlement monuments;
- Pond 15S has 8 settlement monuments;
- Pond 16S has 8 settlement monuments;

- Pond 17 has 7 settlement monuments; and
- Pond 18 Cell A has 4 settlement monuments.

The settlement monitoring results will be summarized in the *RCRA Pond Annual Post-Closure Report*. Any damage to settlement monuments requiring maintenance will be noted on the inspection form.

Topsoil Depth Monitoring - RCRA ponds that are equipped with a "RCRA double cap" incorporate an ET cap (as installed on RCRA Ponds 8S, Phase IV, 15S, 16S and 18 Cell A) and as such include topsoil depth monitoring. The topsoil depth indicators installed on each RCRA pond with an ET cap will be inspected and soil levels recorded semiannually and within 48 hours of a high wind event. A high wind event is defined as a calendar day during which the sustained (1-minute averaging time) maximum wind speed exceeds 70 miles per hour as recorded at the Pocatello airport weather station. Wind speeds in excess of 70 miles per hour have been recorded at the Pocatello airport only in March. Thus a triggering wind event would most likely occur in March, when the soil is still frozen and snow accumulation may prevent access to all of the topsoil thickness gauges. In the event some or all of the topsoil thickness gauges are not accessible, the high wind event topsoil depth monitoring will be performed within 48 hours of meteorological conditions that would make all of the gauges accessible.

The RCRA ponds are equipped with the following number of topsoil indicators:

- Pond 8S has 7 topsoil indicators
- Phase IV Ponds have 19 topsoil indicators
- Pond 15S has 18 topsoil indicators
- Pond 16S has 18 topsoil indicators
- Pond 18 Cell A has 14 topsoil indicators

The topsoil depth monitoring results will be summarized in the *RCRA Pond Annual Post-Closure Report*. Any damage to topsoil depth indicators requiring maintenance will be noted on the inspection form.

Rodent/Insect Infestation Monitoring – For each of the RCRA ponds, rodent/insect infestation is monitored on a semiannual basis (typically in June and again in September) over the areal extent of the pond cap surface. The rodent/insect inspections will be summarized in the *RCRA Pond Annual Post-Closure Report*. Any areas of the RCRA pond caps that require attention (i.e., repair burrowing activities, seeding, or pest control) will be noted on the inspection form.

ET Cap Drainage Monitoring - RCRA ponds that are equipped with a "RCRA double cap" incorporate an ET cap (as installed on RCRA Ponds 8S, Phase IV, 15S, 16S, and 18 Cell A). As such, ET cap drainage monitoring is performed annually and takes place at the ET cap drainage collection sump(s) at each RCRA pond. The ponds are equipped with the following number of

ET cap drainage collection sump(s) and associated "instrument panels"[1]:

- Pond 8S has 2 ET cap drainage collection sumps;
- Phase IV Ponds have 4 ET cap drainage collection sumps;
- Pond 15S has 2 ET cap drainage collection sumps;
- Pond 16S has 2 ET cap drainage collection sumps; and
- Pond 18 Cell A has 2 ET cap drainage collection sumps.

The ET cap drainage accumulation volumes will be summarized in the *RCRA Pond Annual Post-Closure Report*. Any deficiencies of the ET cap drainage accumulation system requiring maintenance will be noted on the inspection form.

3.2 LCDRS MONITORING

Ponds 8E, 9E, 15S, 16S 17 and 18 Cell A were designed and installed with double liners and an associated leachate collection, detection and removal system (LCDRS). The monitoring is performed on a progressive step-wise schedule per the requirements of 40 CFR § 265.2266(b)(2) and takes place at the LCDRS collection sump(s) at each RCRA pond. The ponds are equipped with the following number of LCDRS collection sump(s):

- Pond 8E has 1 LCDRS collection sump;
- Pond 9E has 6 LCDRS collection sumps;
- Pond 15S has 4 LCDRS collection sumps;
- Pond 16S has 2 LCDRS collection sumps (each has an associated "instrument panel"[2];
- Pond 17 has 1 LCDRS collection sump (with an associated "instrument panel"); and

[1] "Instrument panel" is a generalized term for the steel enclosures that house (1) pressure and temperature data displays / recording modules, (2) pressure and temperature system audible / visual alarms if separate from the data display housing and (3) power supply / switches. The monitoring described in this Section 3.1, ET Cap Drainage Monitoring only applies to the "instrument panels" associated with the ET cap drainage monitoring lift stations. Any other "instrument panels" at the RCRA ponds are addressed under the monitoring for the system with which they are associated (e.g., LCDRS sumps).

[2] "Instrument panel" is a generalized term for the steel enclosures that house (1) pressure and temperature data displays / recording modules, (2) pressure and temperature system audible / visual alarms if separate from the data display housing and (3) power supply / switches. The monitoring described in this Section 3.2 only applies to the "instrument panels" associated with the LCDRS collection sumps. Any other "instrument panels" at the RCRA ponds are addressed under the monitoring for the system with which they are associated (e.g., ET cap drainage lift stations).

- Pond 18 Cell A has 1 LCDRS collection sump (with an associated "instrument panel").

The leachate accumulation volumes will be summarized in the *RCRA Pond Annual Post-Closure Report*. Any deficiencies of the LCDRS requiring maintenance will be noted on the inspection form.

3.3 STORMWATER/SNOWMELT RUNOFF MONITORING

All of the RCRA ponds include stormwater/snowmelt runoff monitoring. This monitoring will be conducted on a semiannual basis and within 48 hours of a triggering precipitation event, defined as: 1) 2.1 inches (or more) of precipitation within a 24 hour period (NOAA, 1973) as reported for the Pocatello airport weather station, 2) a rain on snow or frozen soil event of 1.0 inch (or more) of precipitation within a 24 hour period as reported for the Pocatello airport weather station during the period November 15 through April 15 and/or 3) a high wind event, defined as a calendar day during which the sustained (1-minute averaging time) maximum wind speed exceeds 70 miles per hour as recorded at the Pocatello airport weather station. The monitoring will be conducted over the areal extent of the pond surface and at all diversionary/accumulation structures associated with stormwater/snowmelt runoff. The stormwater/snowmelt inspections will be summarized in the *RCRA Pond Annual Post-Closure Report*. Any areas of the RCRA pond caps or diversionary/accumulation structures that require maintenance (i.e., repair erosion channels or seeding) will be noted on the inspection form.

3.4 SURVEY BENCHMARK MONITORING

Survey benchmarks are used to determine the exact location and dimensions of the RCRA ponds and as reference points while performing the RCRA cap settlement monitoring. Survey benchmarks associated with the RCRA ponds will be inspected annually in conjunction with the settlement monument monitoring. The survey benchmark inspections will be reported in the *RCRA Pond Annual Post-Closure Report*. Any survey benchmarks that require maintenance (i.e., damaged, missing, or covered) will be noted on the inspection form.

3.5 RCRA POND SECURITY MONITORING

Monitoring of security systems (i.e., fencing, gates and signs) will be conducted on a semiannual basis at the location of all RCRA pond perimeter fences, gates, and security signs. Warning signs will be posted on each vehicle gate and man gate located along the RCRA Pond area fenceline. Additionally, a warning sign will be placed at a spacing of at least one sign per 500 lineal feet of fence between gates. Figure 2-2 of the *Post-Closure Plan* shows the location of the RCRA Pond area perimeter fence and required locations for warning signs. The security system monitoring results will be summarized in the annual *RCRA Pond Annual Post-Closure Report*. Any security systems that require maintenance (i.e., damaged, missing, or covered) will be noted on the inspection form.

3.6 TMP ENCLOSURE AND PERIMETER PIPING STANDPIPE MONITORING

The Temperature Monitoring Points (TMPs) formerly used for temperature monitoring, housed within locking enclosures, and perimeter piping standpipes formerly used for pressure monitoring or contingent gas extraction, with one standpipe per pond equipped with a pressure transducer, are no longer used for their original purpose. Nonetheless, these physical appurtenances remain and will be monitored annually to ensure they remain intact and are secured. The ponds are equipped with the following number of TMPs and perimeter pipe standpipes:

- Pond 8E has 4 TMP enclosures and 1 perimeter pipe standpipe;
- Pond 9E has 10 TMP enclosures and 1 perimeter pipe standpipe;
- Pond 8S has 4 TMP enclosures and 1 perimeter pipe standpipe;
- Phase IV Ponds:
    - Pond 11S has 4 TMP enclosures and 1 perimeter pipe standpipe
    - Pond 12S has 4 TMP enclosures and 1 perimeter pipe standpipe
    - Pond 13S has 4 TMP enclosures and 1 perimeter pipe standpipe
    - Pond 14S has 1 TMP enclosure and 1 perimeter pipe standpipe;
- Pond 15S has 10 TMP enclosures and 2 perimeter pipe standpipes;
- Pond 16S has 8 TMP enclosures and 4 perimeter pipe standpipes;
- Pond 17 has 6 TMP enclosures and 4 perimeter pipe standpipes; and
- Pond 18 Cell A has 3 TMP enclosures and 2 perimeter pipe standpipes.

The TMP and standpipe monitoring results will be summarized in the *RCRA Pond Annual Post-Closure Report*. Any deficiencies requiring maintenance will be noted on the inspection form.

3.7 POND 16S CAP ROAD MONITORING

Monitoring of the Pond 16S cap road will be conducted on a semiannual basis and within 48 hours of a triggering precipitation event, defined as: 1) 2.1 inches (or more) of precipitation within a 24 hour period (NOAA, 1973) as reported for the Pocatello airport weather station, and/or 2) a rain on snow or frozen soil event of 1.0 inch (or more) of precipitation within a 24 hour period as reported for the Pocatello airport weather station during the period November 15 through April 15. The monitoring will be conducted over the areal extent of the Pond 16S cap road and all associated stormwater/snowmelt runoff diversionary structures. The stormwater/snowmelt inspections are summarized in the *RCRA Pond Annual Post-Closure*

Report. Any areas of the Pond 16S cap road or diversionary structures that require maintenance (i.e., repair culverts or seeding) are noted on the inspection form.

This Pond 16S cap road monitoring will be performed as long as the pond cap road remains on the cap surface. FMC will develop a separate work plan should it seek to remove the Pond 16S cap road in the future and will submit the work plan to EPA for review and approval prior to commencing any work to remove the road.

4.0 MONITORING PROCEDURES

This section describes the procedures to be used to perform the RCRA cap monitoring and record results. All monitoring will be conducted in accordance with the procedures presented in this section and associated attachments.

Each of the monitoring procedures in this section prescribes the method of observing and documenting variances to acceptable conditions at each of the RCRA ponds on a routine basis. In addition to the post-closure monitoring and maintenance activities described in this section, all FMC and FMC contractor personnel working in the RCRA Ponds area will be responsible for reporting to FMC any observations of conditions that are or reasonably may represent an unacceptable condition at any time. FMC will be responsible for recording the reported condition, assessing the condition based on the requirements of this plan and performing any necessary maintenance to correct unacceptable conditions.

4.1 FIELD DOCUMENTATION

4.1.1 FIELD INSPECTION AND MAINTENANCE FORMS

Field inspection and maintenance forms will document information/data obtained in the field as well as maintenance activities. Field form entries will be complete and accurate enough to permit reconstruction of field activities. At a minimum, the following monitoring information will be recorded:

- Monitoring location and description.
- Monitor/Inspector's name(s).
- Date and time of inspection and monitoring.
- Type of monitoring equipment used.
- Measurement data (e.g. soil thickness). The data will include the numerical value and the units of each measurement.
- Field observations and details important to interpreting the monitoring results (e.g., heavy rains, odors, colors).
- Issues that require maintenance attention.
- Any other observation relevant to a potential threat to cap integrity.

The date(s) of monitoring (monitoring period) will be indicated in mm/dd/yy format, and the time will be indicated in accordance with the military convention. The monitored parameter will be indicated in an unambiguous shorthand.

Each form will be dated and the time of entry noted in military time. All entries will be legible, written in black, waterproof ink, and signed by the individual making the entries. The person recording the notes will sign and date the bottom of every page. Changes will be crossed out with a single line so that the original text remains legible; the change will be initialed and dated. Language will be factual, objective, and free of personal opinions or inappropriate terminology.

4.1.2 PHOTOGRAPHS

In addition to written records, photographs also may be taken as necessary to supplement written descriptions of field activities entered on inspection and maintenance forms.

4.2 SAMPLE LABELING, CHAIN-OF-CUSTODY, HANDLING, AND SHIPPING

While the RCRA cap monitoring activities do not routinely involve sampling and laboratory analysis, there are occasions when RCRA waste determination sampling may be performed as described in Section 5.2 of the *RCRA Post-Closure Plan.* In these cases of non-routine sampling, the following sample handling procedures will apply.

Sample Labeling: A label will be placed on each sample container submitted for analysis and will include the following information:

- Project name and location
- Sample designation
- Date and time of sample collection
- Preservative (if applicable)
- Sampler's initials
- Requested analyses.

Sample Chain-of-Custody: A chain-of-custody form will be completed and will accompany each sample cooler submitted to the laboratory. This form includes project identification, project location, sample designation, and analysis type. In addition, there are spaces for entry of the sample collection date and time, signatures of the persons relinquishing and receiving samples, and the conditions of the samples upon receipt by the laboratory.

*Sample Handling and Shipping***:** After collection of each sample, the sample container will be placed in a cool dry place pending delivery to the laboratory (e.g., a sturdy cardboard box or plastic cooler).

Because none of the waste determination analyses anticipated for waste determination have short holding times, samples will be delivered to the laboratory either by the sampling team or by carrier (e.g., FedEx, UPS), at the discretion of the sampling team. If samples are to be delivered

to the laboratory on a Saturday or Sunday, the laboratory will be contacted to arrange for sample acceptance.

4.3 CAP INTEGRITY AND EFFECTIVENESS MONITORING PROCEDURES

4.3.1 CAP SURFACE VEGETATION MONITORING PROCEDURES

The cap vegetation cover surveys will be performed annually on the surface of each of the RCRA pond caps. The purpose of the vegetation monitoring is to visually inspect the RCRA pond cap surface that includes the external cap slopes to determine if areas void of vegetation are developing. Therefore, the vegetation cover survey will be performed in the fall at the end of the growing season (typically in September just prior to re-seeding, if required). All RCRA ponds will be inspected following the methodology described in Guidelines for Determining Stand Establishment on Pasture, Range and Conservation Seedings (USDA, January 2008).

Using the inspection form, the inspector will perform the following at on the surface of each RCRA pond cap:

- Record the date, time, inspector's name on the form and sign the form.
- Establish three transects across the surface of the RCRA pond cap. Each transect will have: 1) a random origin, 2) a random direction, and 3) have a different origin than any of the transects used during the previous vegetation monitoring event. Document the approximate location and direction of each of the three transects on the inspection form.
- For each transect, walk across the pond cap surface from one side to the opposite side and appraise the variability of the vegetation. On the way back, sample representative areas ('plots') of the cap surface using a pace transect. A square frame will be used to count plants within each plot. The frame will be placed so all four sides touch the ground surface (e.g., do not set plot frame edge directly on top of a bunch grass or sage brush).
- Record the number of three-leaved (or more) plants (e.g., grasses, shrubs) in a 9 square foot plot (i.e., within a 3-foot square frame placed on the ground); walk an appropriate number of paces such that the ten sampling plots will be uniformly spaced across the transect (e.g., ten paces [about 30 feet] between each plot for a 330 foot transect) and record again; repeat counting plots until 10 stops have been made. Divide the total number of plants counted by 9 to calculate the number of plants per square foot at each plot / sample (i.e., calculate plant density for each individual 9 square foot plot).
- Complete three transects and 10-stop plots / samples per transect. Transects will be evenly spaced across the cap surface (e.g., one across the eastern third, one across center and one across western third of Pond 15S) but should also be randomly selected for each monitoring event. Due to the pond cap road on Pond 16S, if a plot / sample lands on the cap road, the plot will be moved adjacent to the road prior to counting plants, then continue pacing to next plots / samples.
- Also note any ponding of accumulated precipitation, erosion channels, or evidence of rodent/insect activity that may impact vegetation cover. Any of these areas requiring maintenance will be entered on the maintenance form. Record the date entered on the maintenance form.

- When completed, the plant density will have been counted at and calculated for each of the 30 individual plots. If two-thirds (20 of 30) of the plot samples or more from the 30 total samples from the three transects and 10 samples per transect meet or exceed the minimum target density of 0.5 plants per square foot, then maintenance is not required.
- If less than two-thirds of the total 30 samples meet or exceed the minimum target density of 0.5 plants per square foot, then the cap vegetation will require maintenance and will be entered onto the maintenance form. Record the date entered on the maintenance form. Cap vegetation will typically involve reseeding the areas of poor coverage based on specific transect / plot locations that were below the target density using the vegetation seed mix specified in Table 2.2 of the *RCRA Pond Post-Closure Plan*. Reseeding will be performed in the fall (typically in October). In areas where reseeding does not result in established vegetation on areas with continued erosion problems, primarily on the steeper external pond cap slopes, erosion *mats may be placed to hel*p establish vegetation and minimize erosion. Following completion of maintenance and/or re-seeding, confirmation of completion of repairs will be documented on the maintenance form.

In the event that the vegetation coverage fails to meet the performance standard (two-thirds of the plot samples (67%) or more from the aggregate three transects and 10 samples per transect [30 total samples] meet or exceed the minimum target density of 0.5 *p*lants per square foot) for two (2) consecutive years following the first reseeding performed due to a failure to meet the performance standard, FMC will prepare a plan including a schedule for an investigation to determine the cause and recommended actions to reestablish a vegetation cover that meets the performance standard. The plan and schedule will be submitted to the EPA RCRA Project Manager prior to implementation of the investigation.

4.3.2 CAP SETTLEMENT MONITORING PROCEDURES

The cap settlement monument monitoring will be performed on the surface of each RCRA pond cap (1) annually; (2) if visible subsidence is noted during semiannual run-on and/or run-off erosion monitoring or other monitoring and/or maintenance; and (3) after local seismic events. The criteria for visible subsidence requiring settlement monitoring has been established as an area of 100 square feet (a 10 foot by 10 foot or 11 foot diameter area) or greater where precipitation ponding is observed or could occur to a depth of 1 inch of water or greater. A triggering seismic event is defined as an event that (1) exceeds a magnitude 5.0 on the Richter Scale with an epicenter within a 20-mile radius as reported by USGS or (2) exceeds a magnitude 6.0 on the Richter Scale with an epicenter within a 50-mile radius as reported by USGS. To monitor final cover settlement on all the RCRA ponds, the elevation and coordinates of each monument will be surveyed to determine the vertical and horizontal components of the final cover monuments. For accuracy, a surveying instrument will be used to take measurements with the following tolerances:

- Elevation readings: 0.01 foot
- Horizontal displacement: 0.1 foot

Elevation and displacement measurements will be plotted cumulatively versus time. The time scale will be in logarithm of time or square root of time. The settlement curve will be kept up to date with each reading. The displacement measurements (vertical and horizontal movements) will be made annually during the remaining post-closure period or until the total cumulative movements for the last five years are less than the following limits:

- Vertical settlement: 0.03 foot
- Horizontal movement: 0.2 foot

Displacement measurements will be made (1) at least once every five years during the post-closure period after the above limits are reached; (2) if visible subsidence is noted during semiannual run-on and/or run-off erosion monitoring or other monitoring and/or maintenance; and (3) after local seismic events. The criteria for visible subsidence and a triggering seismic event are defined above. Settlement monitoring will be based on control stations "94-1" and "94-4," which are local stations in FMC's survey control system. The coordinates for these stations were derived from the U.S. Coast & Geodetic Survey (US C&GS) Control Station MCDOUGAL-2 and BM Y-96. The vertical datum is based on the 1968 adjustment of the National Geodetic Vertical Datum of 1929 (NGVD 29) by the US C&GS.

Any damaged monument detected during post-closure inspections/measurements will be noted on the surveyor's field log and entered on the maintenance form. Any maintenance necessary to clear access to or repair settlement monuments will be performed as soon as practicable so as not to cause any delay for the next scheduled monitoring event.

Any repairs or maintenance of the final cover necessary due to observed visible subsidence will be performed as soon as practicable so as not to cause any localized ponding of precipitation on the cap surface or if the subsidence was identified due to observed localized ponding of precipitation on the cap surface so as to eliminate the potential for future ponding of precipitation on the cap surface. An area of 100 square feet (a 10 foot by 10 foot or 11 foot diameter area) or greater where precipitation ponding is observed or could occur to a depth of 1 inch of water or greater will require maintenance as soon as practicable. Repairs and/or maintenance to eliminate or prevent potential ponding on the cap surface will commence within seven (7) days unless delayed as specified below. Commencement of repairs and/or maintenance includes actual field work (for simple or minor maintenance) and initiation of engineering, planning and/or procurement of additional materials to perform the maintenance and/or repairs (for more complex or larger scale maintenance). Maintenance or repairs will not be performed if frozen soil / snow cover / muddy conditions exist such that cap surface could be damaged as a result of gaining access to implement the repair/maintenance activity or are not feasible due to frozen soil conditions (typically between November 15 through April 15) at the RCRA pond where maintenance/repairs are required. If maintenance or repairs are delayed by surface conditions, any repairs or maintenance will commence within seven (7) days of the presence of acceptable cap surface conditions. In the event maintenance or repairs must be delayed beyond commencement within seven (7) days for cause(s) other than frozen soil / snow cover / muddy conditions, FMC will notify EPA within 48 hours of the observation of a condition for which the

maintenance/repair will be delayed. The notification will include a description of the reason(s) for the necessary delay and a schedule for commencing the maintenance and/or repairs.

All repairs to the final cover will be conducted in accordance with the final cover construction specifications, and all testing and inspections will be conducted in accordance with the final cover *Construction Quality Assurance* (CQA) *Plan* attached to the each of the RCRA Pond Closure Plans. Following completion of repairs, confirmation of completion of repairs will be documented on the maintenance form.

4.3.3 ET CAP TOPSOIL DEPTH MONITORING PROCEDURES

The ET cap topsoil depth monitoring will be performed on the surface of each RCRA pond cap semiannually and within 48 hours of a high wind event. A high wind event is defined as a calendar day during which the sustained (1-minute averaging time) maximum wind speed exceeds 70 miles per hour as recorded at the Pocatello airport weather station. Wind speeds in excess of 70 miles per hour have been recorded at the Pocatello airport only in March. Thus a triggering wind event would most likely occur in March, when the soil is still frozen and snow accumulation may prevent access to all of the topsoil thickness gauges. In the event some or all of the topsoil thickness gauges are not accessible, the high wind event topsoil depth monitoring will be performed within 48 hours of meteorological conditions that would make all of the gauges accessible.

RCRA ponds that are equipped with a "RCRA double cap" (RCRA Ponds 8S, Phase IV, 15S, 16S, and 18 Cell A) will be monitored for topsoil depth. Using the *inspection form*, the inspector will perform the following at each of the above identified RCRA pond caps:

- Record the date, time, inspector's name on the form and sign the form.
- Using a tape measure or other measuring device, measure the depth from the scribed reference line to the topsoil surface. Record the measurement on the form.
- Determine the topsoil loss as the difference between the installed topsoil level (original level as indicated on the form) and the current topsoil level (as measured). Record the difference (topsoil loss).
- Record any unacceptable conditions (e.g., missing or damaged topsoil depth indicators) requiring maintenance and enter on the maintenance form. Record the date entered on the maintenance form.
- Any maintenance necessary to clear access to or repair topsoil depth indicators will be performed as soon as practicable so as not to cause any delay for the next scheduled monitoring event. Confirmation of completion of repairs will be documented on the maintenance form.
- If the topsoil measurement shows 5 inches of loss below the installed thickness at 50-percent of the indicators on the RCRA Ponds with the RCRA "double caps" cap, the total cap area will be evaluated within 30 days. The entire pond cap surface will be surveyed to prepare a current cap surface elevation contour map. The current surface elevations

will be compared to the final as-built final cap elevations documented in the respective Pond Closure Reports. If more than 50-percent of the cap surface shows 5 inches of loss below the as-built surface, maintenance (e.g., replacement of topsoil and reseeding) will be performed as soon as practicable. Topsoil replacement will not be performed if frozen soil / snow cover / highly muddy conditions exist (typically between November 15 through April 15) at the RCRA pond where topsoil replacement is required, but, if delayed by surface conditions topsoil replacement will commence within seven (7) days of the presence of acceptable cap surface conditions. Commencement of repairs and/or maintenance includes actual field work (for simple or minor maintenance) and initiation of engineering, planning and/or procurement of additional materials to perform the maintenance and/or repairs (for more complex or larger scale maintenance). As stated in Section 4.3.1 of this *FSP*, any reseeding required following topsoil replacement will be performed in the fall (typically in October).

All necessary repairs to the cap surface will be performed by FMC in accordance with the procedures as specified in the final cover construction specifications, including any testing and inspections as required by the final cover CQA Plan attached to the RCRA Pond Closure Plans. Documentation of all repairs to the cap surface will be maintained in the Operating Record.

4.3.4 CAP RODENT/INSECT INFESTATION MONITORING PROCEDURES

The cap rodent/insect monitoring will be performed semiannually. The purpose of the cap rodent/insect infestation monitoring is to inspect the RCRA cap surface to visually identify evidence of rodent burrowing or loss of vegetation from rodent or insect feeding. Inspections will be performed during the late spring (typically in June) and again in the fall (typically in September when burrowing rodents and insect activity has declined).

Using the inspection form, the inspector will perform the following at each RCRA pond:

- Record the date, time, inspector's name on the form and sign the form.
- Walk or drive around the outside of the pond cap perimeter. Note any evidence of unusual rodent or insect activities, i.e., excessive burrowing, mounds of soil, and/or loss of vegetation that, in the judgment of the inspector, would result in poor vegetation coverage per surface vegetation monitoring or unacceptable soil erosion per run-off erosion monitoring.
- Walk over and observe the surface of the RCRA pond cap. Note any evidence of unusual rodent or insect activities, i.e., excessive burrowing, mounds of soil, and/or loss of vegetation that, in the judgment of the inspector, would result in poor vegetation coverage per surface vegetation monitoring or unacceptable soil erosion per run-off erosion monitoring.
- Record any unacceptable conditions requiring maintenance and enter on the maintenance form. Record the date entered on the maintenance form.
- Corrective actions to address rodent/insect activity, e.g., fill holes or burrows, will be performed as soon as practicable. Maintenance to fill holes or burrows will not be

performed if frozen soil / snow cover / highly muddy conditions exist (typically between November 15 through April 15) at the RCRA pond where the maintenance is required, but, if delayed by surface conditions filling holes / burrows will commence within seven (7) days of the presence of acceptable cap surface conditions. Localized reseeding may be performed during spring (typically March through May) but if reseeding is required pursuant to Section 4.3.1 of this *FSP*, reseeding will be performed in the fall (typically in October). Burrowing or insect activity may also warrant the use of pesticides to eradicate the pest. Following completion of repairs/corrective actions, confirmation will be documented on the maintenance form.

4.3.5 ET CAP DRAINAGE MONITORING PROCEDURES

The ET cap drainage monitoring will be performed annually at each of the RCRA pond caps. RCRA ponds that are equipped with a "RCRA double cap" incorporate an ET cap (as installed on subject RCRA Ponds 8S, Phase IV, 15S, 16S and 18 Cell A). The purpose of the ET drainage monitoring is to determine and record the volume and rate of ET cap drainage collected at each of these ponds on a annual basis. Each of these ponds is equipped with one or more ET cap drainage collection sumps and associated "instrument panels[3]" as listed below:

- Pond 8S has 2 cap drainage collection sumps;
- Phase IV Ponds have 4 cap drainage collection sumps;
- Pond 15S has 2 cap drainage collection sumps;
- Pond 16S has 2 cap drainage collection sumps; and
- Pond 18 Cell A has 2 cap drainage collection sumps.

Using the inspection form, the inspector will perform the following at each cap drainage collection sump:

- Record the date, time, inspector's name on the form and sign the form.
- Inspect the manhole cover and collection sump and record the condition on the form. Specifically note any conditions requiring maintenance attention.
- If present, inspect the instrument panel to determine if the panel is intact and the door is secure. Specifically note any conditions requiring maintenance attention.
- Record any unacceptable conditions requiring maintenance and enter on the maintenance form. Record the date entered on the maintenance form.

[3] "Instrument panels" is a generalized term for the steel enclosures that house (1) pressure and temperature data displays / recording modules, (2) pressure and temperature system audible / visual alarms if separate from the data display housing and (3) power supply / switches. The monitoring described in this Section 4.3.5 only applies to the "instrument panels" associated with the ET cap drainage monitoring lift stations. Any other "instrument panels" at the RCRA ponds are addressed under the monitoring for the system with which they are associated (e.g., LCDRS sumps).

- Inspect the cap drainage collection sump and record if water is present. Use a calibrated dipstick to measure the water level in the sump and record the sump level. The sumps have been calibrated to provide depth vs. volume conversions.
- Using the current water level measurement, determine the accumulated sump volume. Compare to the previously measured annual sump volume to determine annual seepage rate.
- If the sump level is greater than 36 inches (approximately ¾ full), the sump will be pumped. Pump the accumulated water using the dedicated sump pump or a portable pump if the dedicated pump is no longer functional. As this water is strictly ET cap drainage water (i.e., precipitation), the water is non-hazardous and will be pumped to the ground. If the sump is pumped, record the sump level after pumping – this will be the water level / sump volume for comparison with the next year's water level / sump volume.
- The measured annual seepage rate, which represents the percolation at the drainage layer at the bottom of the capillary barrier, will be compared to the maximum annual percolation of 10-4 in/yr predicted by the UNSAT-H model for the simulated 600 year period for each individual RCRA pond. These predicted maximum annual percolation rates for each pond are presented on Table 2.0.

Table 2.0.
Maximum Annual Percolation Rate Through the ET Cap
As Predicted by UNSAT-H Model

RCRA Pond	Maximum Annual Percolation Rate (gallons)
Pond 8S	13
Phase IV Ponds	13 for each individual pond
Pond 15S	30
Pond 16S	30
Pond 18 Cell A	15

If the measured seepage rate is less than the maximum annual percolation rate, the performance of the cap will be deemed satisfactory. Annual drainage monitoring will continue.

- If the measured seepage rate exceeds the maximum annual predicted seepage rate, the following actions will be taken:
    a. Check to determine if the drainage system is working properly, including but not limited to whether precipitation/water other than cap drainage through the ET cap is getting into the collection sump, for example between the manhole section joints or pipe penetrations through the manhole wall. Take corrective actions as necessary to repair the drainage system component(s).

b. If the drainage system is working properly and the accumulated water is determined to be infiltrating through the ET capillary barrier, then the ET cap will be re-evaluated based on the recorded daily rainfall and temperature data for that year using the UNSAT-H model, thus creating a revised maximum annual predicted seepage rate.

- If the measured seepage rate exceeds the revised maximum annual predicted seepage rate, FMC will inspect the ET cap for specific cause or damage. If the specific cause or damage is found, the cap will be repaired as described below under Maintenance.
- If a specific cause or damage is not found, the cap design and construction will be re-evaluated and the capillary barrier portion of the cap will be re-designed as required to ensure the performance of the ET layer component of the cap meets the performance standards specified in the closure plan. FMC will notify EPA RCRA Project Manager within seven (7) days of any determination that FMC will perform a re-evaluation and re-design of the capillary barrier portion of the cap. FMC will submit the re-design and plan for construction of any modifications to EPA for approval within 30 days of EPA notification or as otherwise agreed to by EPA. The required modifications to the capillary barrier will be constructed during the next construction season in accordance with the plan as approved or modified by EPA, while taking care not to damage the underlying low-permeability composite cap layer.

- Any maintenance shown to be necessary based on inspection of the ET cap drainage system will be performed as soon as practicable. Repairs and/or maintenance to correct identified damage or cause (of excess infiltration) will commence within seven (7) days unless delayed as specified below. Commencement of repairs and/or maintenance includes actual field work (for simple or minor maintenance) and initiation of engineering, planning and/or procurement of additional materials to perform the maintenance and/or repairs (for more complex or larger scale maintenance). Maintenance or repairs will not be performed if frozen soil / snow cover / muddy conditions exist such that cap surface could be damaged as a result of gaining access to implement the repair/maintenance activity or are not feasible due to frozen soil conditions (typically between November 15 through April 15) at the RCRA pond where maintenance/repairs are required. If maintenance or repairs are delayed by surface conditions, any repairs or maintenance will commence within seven (7) days of the presence of acceptable cap surface conditions. In the event maintenance or repairs must be delayed beyond commencement within seven (7) days for cause(s) other than frozen soil / snow cover / muddy conditions, FMC will notify EPA within 48 hours of the observation of a condition for which the maintenance/repair will be delayed. The notification will include a description of the reason(s) for the necessary delay and a schedule for commencing the maintenance and/or repairs. Documentation of all repairs and maintenance activities will be maintained in the Operating Record.

4.4 LCDRS MONITORING PROCEDURES

The LCDRS for each RCRA pond equipped with a functioning LCDRS (Ponds 8E, 9E, 15S, 16S, 17 and 18 Cell A) will be visually inspected to determine if: 1) the manhole cover is in place and undamaged, 2) if the collection sumps are undamaged, 3) if the pumps and flowmeter/totalizer are in working order, and 3) liquids have accumulated above the invert of the inlet pipe to the sump. The LCDRS sump inspections will be performed on a progressive step-wise schedule per the requirements of 40 CFR 268.226(b)(2), i.e., inspections will initially be performed monthly. If no liquids are present above the invert of the inlet pipe to the sump (i.e., no accumulation) for two consecutive months, inspections will go to quarterly. If no liquids are present above the invert of the inlet pipe to the sump for two consecutive quarters, inspections will go to semiannually and will remain at semiannually until such time as accumulation of liquid is observed. If liquid accumulation is observed, (i.e., liquids are present above the invert of the inlet pipe to the sump), then inspections will revert to monthly and the progressive step-wise schedule will start over. The LCDRS procedures applicable to each of these ponds are provided below.

Prior to going to the field, the inspector will review the most recent RCRA waste determination for water in each LCDRS collection sump in order to guide the appropriate method of disposal if the collection sump is pumped. Accumulated water in each LDCRS collection sump, if present, will be periodically sampled and analyzed for TCLP metals and pH. However, if field observations indicate unusual conditions, such as unusual color or odors associated with the LCDRS leachate, or if the volume pumped during the prior month or quarter (depending on monitoring schedule) is greater than 20-percent higher than the average from the previous two (2) calendar years volume pumped during the same month or quarter for the same LCDRS manhole, the LCDRS water will be sampled and analyzed for pH and TCLP metals prior to pumping to re-confirm (or modify) the previous waste determination. In accordance with 40 CFR 265.73(b)(3), records and results of waste analysis, waste determinations, and any trial tests performed will be recorded and maintained in the facility's Operating Record.

Using the inspection form, the inspector will perform the following at each LCDRS collection sump:

- Record the date, time, inspector's name on the form and sign the form.
- Inspect the manhole cover and LCDRS collection sump and record the condition on the form. Specifically note any conditions requiring maintenance attention.
- If present, inspect the LCDRS collection instrument panel[4] to determine if the panel is intact and the door is secure.

[4] "Instrument panel" is a generalized term for the steel enclosures that house (1) pressure and temperature data displays / recording modules, (2) pressure and temperature system audible / visual alarms if separate from the data display housing and (3) power supply / switches. The monitoring described in this Section 4.4 only applies to the "instrument panels" associated with the LCDRS collection sumps. Any other "instrument panels" at the RCRA ponds are addressed under the monitoring for the system with which they are associated (e.g., ET cap drainage lift stations).

- Inspect the LCDRS collection sump and record if water/leachate is present above the invert of the inlet pipe to the sump. If no water/leachate is present above the invert of the inlet pipe to the sump, skip the next step on pumping the water/leachate.
- If water/leachate is present above the invert of the inlet pipe to the sump, turn on the pump and record the volume pumped.
- Record any field notes on the leachate pumping.
- Record any unacceptable conditions requiring maintenance and enter on the maintenance form. Record the date entered on the maintenance form.
- Any maintenance shown to be required during the inspection of the LCDRS will be performed as soon as practicable. Repairs and/or maintenance of the manhole covers, sumps and pump (for Pond 18 Cell A dedicated pump only) will commence within seven (7) days unless delayed as specified below. Commencement of repairs and/or maintenance includes actual field work (for simple or minor maintenance) and initiation of engineering, planning and/or procurement of additional materials to perform the maintenance and/or repairs (for more complex or larger scale maintenance). Maintenance or repairs will not be performed if frozen soil / snow cover / muddy conditions exist such that cap surface could be damaged as a result of gaining access to implement the repair/maintenance activity or are not feasible due to frozen soil conditions (typically between November 15 through April 15) at the RCRA pond where maintenance/repairs are required. If maintenance or repairs are delayed by surface conditions, any repairs or maintenance will commence within seven (7) days of the presence of acceptable cap surface conditions. In the event maintenance or repairs must be delayed beyond commencement within seven (7) days for cause(s) other than frozen soil / snow cover / muddy conditions, FMC will notify EPA within 48 hours of the observation of a condition for which the maintenance/repair will be delayed. The notification will include a description of the reason(s) for the necessary delay and a schedule for commencing the maintenance and/or repairs.
- Following completion of repairs, confirmation will be documented on the maintenance form. Based upon the waste determination, water/leachate disposition will be performed per the procedures outlined in Section 5.0 of the *RCRA Post-Closure Plan.*

4.5 CAP STORMWATER/SNOWMELT RUNOFF MONITORING PROCEDURES

The cap stormwater/snowmelt runoff monitoring will be performed (1) semi-annually, (2) within 48 hours of a 25-year, 24-hour storm event defined as 2.1 inches (or more) of precipitation within a 24 hour period (NOAA, 1973) as reported for the Pocatello airport weather station, and (3) within 48 hours of a rain on snow or frozen soil event of 1.0 inch (or more) of rain precipitation within a 24-hour period as reported for the Pocatello airport weather station during the period November 15 through April 15. The objective of these visual inspections will be to determine if cap surface erosion or ponding has occurred. The criteria for localized erosion or ponding requiring maintenance has been established as an area of 100 square feet (a 10 foot by 10 foot or 11 foot diameter area) or greater where precipitation ponding is observed or could occur to a depth of 1 inch of water or greater. Stormwater/snowmelt diversionary/accumulation

systems are inspected to note and remove debris, sediment, or other obstructions. As the stormwater/snowmelt runoff monitoring requires that the surface of the cap and the associated diversionary structures are visible, this monitoring cannot be performed if the cap is snow-covered. If snow-covered, the stormwater/snowmelt runoff monitoring will be re-scheduled when conditions permit inspection.

In addition, the RCRA Pond caps will be visually inspected within 48 hours of a high wind event. A high wind event is defined as a calendar day during which the sustained (1-minute averaging time) maximum wind speed exceeds 70 miles per hour as recorded at the Pocatello airport weather station. Wind speeds in excess of 70 miles per hour have been recorded at the Pocatello airport only in March. Thus a triggering wind event would most likely occur in March, when the soil is still frozen and snow accumulation may prevent access to all or areas of the cap surface and/or diversion and drainage structures. In the event some or all areas of the cap surface and/or diversion and drainage structures are not accessible, the high wind event monitoring will be performed within 48 hours of meteorological conditions that would make all areas of the cap surface and diversion and drainage structures accessible. The objective of the high wind event visual inspection will be to determine if cap surface erosion and / or accumulation of debris or sediment in the diversion and drainage structures has occurred.

Using the inspection form, the inspector will perform the following at each RCRA pond:

- Record the date, time, inspector's name on the form and sign the form.
- Walk or drive around the outside of the pond cap perimeter. Note any evidence of sheet erosion or erosion channels (rills). In areas where erosion mats have been placed, check the condition of the cap surface and erosion mats to determine if one or more mats need to be replaced.
- Walk over the entire surface of the RCRA pond cap. Note any evidence of sheet erosion or erosion channels. In areas where erosion mats have been placed, check the condition of the cap surface and erosion mats to determine if one or more mats need to be replaced.
- Note any ponding of accumulated precipitation particularly areas of 100 square feet (a 10 foot by 10 foot or 11 foot diameter area) or greater where precipitation ponding is observed or could occur to a depth of 1 inch of water or greater, erosion channels, or evidence of rodent activity that, in the judgment of the inspector, could reasonably be expected to result in soil erosion per run-off erosion that could compromise the integrity and functionality of the cap system..
- Inspect all associated stormwater diversionary structures (i.e., swales, ditches, accumulation areas, etc.) and note any excessive erosion or other damage and/or accumulation of sediment or debris that could impair the functionality of the diversion and drainage structures.
- Record any unacceptable conditions requiring maintenance and enter on the maintenance form. Record the date entered on the maintenance form.
- Any maintenance shown to be required based on inspection of the RCRA Ponds cap surface and diversion structures will be performed as soon as practicable. Maintenance

or repairs to the diversion and drainage structures that could impair the functionality of the diversion and drainage structures and maintenance and/or repairs to eliminate or prevent potential ponding on the cap surface will commence within seven (7) days unless delayed as specified below. Commencement of repairs and/or maintenance includes actual field work (for simple or minor maintenance) and initiation of engineering, planning and/or procurement of additional materials to perform the maintenance and/or repairs (for more complex or larger scale maintenance). Maintenance or repairs will not be performed if frozen soil / snow cover / muddy conditions exist such that cap surface could be damaged as a result of gaining access to implement the repair/maintenance activity or are not feasible due to frozen soil conditions (typically between November 15 through April 15) at the RCRA pond where maintenance/repairs are required. If maintenance or repairs are delayed by surface conditions, any repairs or maintenance will commence within seven (7) days of the presence of acceptable cap surface conditions. In the event maintenance or repairs must be delayed beyond commencement within seven (7) days for cause(s) other than frozen soil / snow cover / muddy conditions, FMC will notify EPA within 48 hours of the observation of a condition for which the maintenance/repair will be delayed. The notification will include a description of the reason(s) for the necessary delay and a schedule for commencing the maintenance and/or repairs.

- Following completion of repairs, confirmation will be documented on the maintenance form.

4.6 SURVEY BENCHMARK AND SECURITY MONITORING PROCEDURES

Monitoring of survey benchmarks will be conducted annually at the same time as the settlement monument monitoring is performed. The surveyor performing the settlement monitoring will inspect the following at each survey benchmark control stations:

- Ensure the survey benchmark is in place;
- Check for survey benchmark damage;
- Note any evidence of tampering; and
- Record any unacceptable conditions requiring maintenance and enter on the maintenance form. Record the date entered on the maintenance form.
- Any maintenance shown to be required based on inspection of the survey benchmarks will be performed as soon as practicable and within a timeframe that will not delay the next scheduled monitoring event.
- Following completion of repairs, confirmation will be documented on the maintenance form.

Monitoring of security systems will be conducted semiannually to ensure all security systems are in place and functioning as designed. The monitoring will involve:

- Inspections of perimeter fencing around the RCRA ponds to ensure the fences are in place and in good repair;

- Inspections of gates to ensure that gates are closed and locked, except when the workers are present within the fenced area;
- Inspections of warning signs to ensure that signs are properly posted, are legible, and are posted in English;
- Observations of any evidence of unauthorized entry or attempted entry into the fenced RCRA pond area; and
- Record any unacceptable conditions requiring maintenance and enter on the maintenance form. Record the date entered on the maintenance form.
- Any maintenance shown to be required based on inspection of the security systems will be performed as soon as practicable. Repairs and/or maintenance of the fencing, gates and/or warning signs will commence within seven (7) days unless delayed as specified below. Commencement of repairs and/or maintenance means performing actual field work, in the case of simple or minor maintenance, or, in the case of more complex or larger scale maintenance, initiation of engineering, planning and/or procurement of additional materials to perform the maintenance and/or repairs. Maintenance or repairs will not be performed if frozen soil / snow cover / muddy conditions exist such that cap surface could be damaged as a result of attempting to implement the repair/maintenance activity or if that work is not feasible due to frozen soil conditions (typically between November 15 through April 15) at the area where maintenance/repairs are required. If maintenance or repairs are delayed by surface conditions, any repairs or maintenance will commence within seven (7) days of the presence of acceptable cap surface conditions. In the event commencement of maintenance or repairs must be delayed beyond seven (7) days for cause(s) other than unacceptable surface conditions as described above, FMC will notify EPA within the initial 48 hours of the seven (7) day period. The notification will include a description of the reason(s) for the necessary delay and a schedule for commencing the maintenance and/or repairs.
- Following completion of repairs, confirmation will be documented on the maintenance form.

4.7 TMP ENCLOSURE AND STANDPIPE MONITORING PROCEDURES

Monitoring of the TMP enclosures and perimeter pipe standpipes associated with the former temperature and pressure monitoring will be conducted annually to ensure these items are intact and maintained. The monitoring will involve:

- Inspections of the TMP enclosures, lids and locks to ensure the enclosures are intact and the lids are closed and locked;
- Inspections of perimeter pipe standpipes to ensure the standpipes are intact and the caps are in-place and tight; and,
- Record any unacceptable conditions requiring maintenance and enter on the maintenance form. Record the date entered on the maintenance form.

- Any maintenance shown to be required based on inspection of the TMP enclosures and perimeter pipe standpipe(s) will be performed as soon as practicable. Repairs and/or maintenance of the TMP enclosures and perimeter pipe standpipe(s) will commence within seven (7) days unless delayed as specified below. Commencement of repairs and/or maintenance means performing actual field work, in the case of simple or minor maintenance, or, in the case of more complex or larger scale maintenance, initiation of engineering, planning and/or procurement of additional materials to perform the maintenance and/or repairs. Maintenance or repairs will not be performed if frozen soil / snow cover / muddy conditions exist such that cap surface could be damaged as a result of attempting to implement the repair/maintenance activity or if that work is not feasible due to frozen soil conditions (typically between November 15 through April 15) at the area where maintenance/repairs are required. If maintenance or repairs are delayed by surface conditions, any repairs or maintenance will commence within seven (7) days of the presence of acceptable cap surface conditions. In the event commencement of maintenance or repairs must be delayed beyond seven (7) days for cause(s) other than unacceptable surface conditions as described above, FMC will notify EPA within the initial 48 hours of the seven (7) day period. The notification will include a description of the reason(s) for the necessary delay and a schedule for commencing the maintenance and/or repairs.
- Following completion of repairs, confirmation will be documented on the maintenance form.

4.8 POND 16S CAP ROAD MONITORING PROCEDURES

4.8.1 POND CAP ROAD CULVERT MONITORING

There are four 8-inch culverts incorporated into the pond cap road. These culverts are designed to drain precipitation runoff from within the pond cap road perimeter to outside the perimeter. Each culvert has a flow diffuser to dissipate flow velocity and to disperse flow across a larger area of the cap. It is important that the culverts and flow diffusers work as designed in order to prevent cap surface erosion. Therefore, semi-annual visual inspections of all four pond cap road culverts will be performed and recorded on an inspection form. This visual inspection will also be performed and recorded within 48 hours after each 25-year, 24-hour storm event defined as 2.1 inches (or more) of precipitation within a 24-hour period (NOAA, 1973) as reported for the Pocatello airport weather station. A visual inspection will also be performed and recorded within 48 hours of a rain on snow or frozen soil event of 1.0 inch (or more) of precipitation within a 24-hour period as reported for the Pocatello airport weather station during the period November 15 through April 15. The culvert monitoring procedure is as follows:

Inspections: Each of the four pond cap road culverts will be visually inspected. The inspection will encompass the culvert inlet, outlet, and diffuser. The following will be documented if observed:

- Any blockage of the inlet, outlet or diffuser as evidenced by any of the following:
  - Ponding of precipitation runoff at the culvert inlet,
  - Trash, soil or vegetation blockages,
  - Ice blockages,
  - Uneven discharge from the diffuser, or
  - Any erosion patterns around the inlet, over the roadway, or at the diffuser discharge.
- Any damage to the culvert or diffuser as evidenced by any of the following:
  - Crushed, broken or otherwise damaged inlet, outlet, or diffuser; or
  - Crushed culvert under the roadway as evidenced by a collapsed road surface over the culvert.

Maintenance Activities: Any observed blockage or damage to pond cap road culverts will be documented on the inspection form and corrected as soon as practicable. In the event final corrective action cannot be implemented in a reasonable time, interim measures will be evaluated. For example, if runoff is ponding at a culvert inlet as result of an ice blockage that cannot be readily removed, a temporary pumping arrangement will be considered to pump accumulated precipitation off the cap surface. Any observed damage to the cap surface, e.g., erosion, will be managed as prescribed in Section 2.0 of this plan. All corrective actions will be documented on an inspection and maintenance form.

4.8.2 PRECIPITATION ACCUMULATION MONITORING

It is important that precipitation runoff not be allowed to pond anywhere on the Pond 16S cap. Therefore, semi-annual visual inspections of the cap surface will be performed and recorded on an inspection form. This visual inspection will also be performed and recorded within 48 hours after each 25-year, 24-hour storm event defined as 2.1 inches (or more) of precipitation within a 24-hour period (NOAA, 1973) as reported for the Pocatello airport weather station. A visual inspection will also be performed and recorded within 48 hours of a rain on snow or frozen soil event of 1.0 inch (or more) of precipitation within a 24-hour period as reported for the Pocatello airport weather station during the period November 15 through April 15. The precipitation accumulation monitoring procedure is as follows:

Inspection: The entire Pond 16S cap surface will be visually inspected. The inspection will encompass the following features, at a minimum:

- Culvert inlets, outlets, and diffusers;
- All areas adjacent to the pond cap road;
- All areas adjacent to GETS equipment (e.g., piping supports), and
- The perimeter of the cap.

The following will be documented if observed:

- Any ponding of precipitation runoff at the culvert inlet, outlet, and diffusers;
- Any ponding of precipitation runoff along the pond cap road;
- Any ponding of precipitation runoff along GETS equipment on the cap;
- Any ponding of precipitation around the perimeter of the cap; or
- Any discoloration of soil or vegetation, prolific vegetation growth, or other evidence of frequent standing water.

Maintenance Activities: Any observed ponded water will be documented on the inspection form and corrected as soon as practicable. In the event final corrective action cannot be implemented in a reasonable time, interim measures will be evaluated. For example, if runoff is ponding at a culvert inlet as result of an ice blockage that cannot be readily removed, a temporary pumping arrangement will be considered to pump accumulated precipitation off the cap surface. Any observed routine standing water as result of damage to the cap surface, e.g., erosion, low spots, etc., will be managed as prescribed in Section 2.0 of this plan. All corrective actions will be documented on an inspection and maintenance form.

4.9 EQUIPMENT DECONTAMINATION PROCEDURE

Equipment for cap integrity monitoring will not typically require decontamination. All of the monitoring equipment will be dedicated to a specific monitoring location. As a result, there is no possibility of cross contamination.

5.0 DISPOSAL OF WASTE

The following waste streams are anticipated as result of the cap integrity monitoring.

- Anticipated waste generation as result of monitoring and/or maintenance activities:
    - ET cap drainage water;
    - LCDRS water;
    - Debris removed from stormwater ditch maintenance;
    - Groundwater monitoring well purge water;
    - Used equipment and parts from maintenance activities;
    - Spent PPE; and
    - Construction and maintenance debris.

RCRA waste determination and disposal is addressed in Section 5.0 of the *RCRA Pond Post-Closure Plan.*

Table 1.0. RCRA Pond Comparison Summary
FMC Plant Site – Pocatello, ID

Pond Number	Description of Wastes Received	Pond Size (acres) Final Waste Inventory (acre-feet)	Year Put Into Service	Year Last Received Waste	Date Closure Construction Completed & Certification Date	RCRA Waste Management Unit #	Cap Design
8E	Primarily NOSAP (lime-treated) precipitator slurry and residual non-lime treated precipitator slurry / phossy solids	4.1 acres 27 acre-feet	1984	1997	November 2004 January 2005	11	RCRA engineered cap See Figure 1.3 of *RCRA Pond Post-Closure Plan*
9E	Precipitator slurry	12.9 acres 17 acre-feet	1986	1994	December 2000 January 2001	9	RCRA engineered cap See Figure 1.3 of *RCRA Pond Post-Closure Plan*
8S	Phossy water and phossy solids	3.2 acres 44 acre-feet	1970	1981	October 1999 December 1999	7	RCRA double cap See Figure 1.4 of *RCRA Pond Post-Closure Plan*
Phase IV	Phossy water and phossy solids	8.9 acres 43 acre-feet	1980	1998	November 2004 January 2005	8	RCRA double cap See Figure 1.4 of *RCRA Pond Post-Closure Plan*
15S	Phossy water and phossy solids	9.4 acres 140 acre-feet	1982	1993	November 2004 January 2005	3	RCRA double cap See Figure 1.4 of *RCRA Pond Post-Closure Plan*
16S	Phossy water, phossy solids, precipitator slurry, furnace building washwater, phossy solids from the Phase IV Ponds, NOSAP slurry, RCRA pond decant water, and P4 spill cleanup materials	10.2 acres 140 acre-feet	1993	1999	November 2004 January 2005	10	RCRA double cap See Figure 1.4 of *RCRA Pond Post-Closure Plan*
17	RCRA Consent Decree on-specification NOSAP slurry only	9.0 acres 59 acre-feet	1998	2001	November 2005 December 2005	14	RCRA engineered cap See Figure 1.3 of *RCRA Pond Post-Closure Plan*
18 Cell A	Phossy water and phossy solids, minor RCRA Consent Decree off-specification NOSAP slurry	3.8 acres 25 acre-feet	1998	2001	November 2005 December 2005	15	RCRA double cap See Figure 1.4 of *RCRA Pond Post-Closure Plan*

NOSAP = Non-Hazardous Slurry Assurance Project
LCDRS = Leachate collection, detection and removal system
ET = Evapotranspiration
RCRA = Resource Conservation and Recovery Act

APPENDIX B

ESTIMATION OF PERCOLATION RATES THROUGH THE RCRA "DOUBLE" CAP

(from Appendix H of the Pond 16S Closure Plan, July 2003)

APPENDIX H

ESTIMATION OF PERCOLATION RATES THROUGH THE POND 16S PROPOSED CAP DESIGN

TABLE OF CONTENTS

FIGURES

TABLES

1. INTRODUCTION

A modified RCRA cap is proposed in lieu of the EPA-recommended guidance cap (or RCRA-guidance cap) for the closure of Pond 16S at the FMC facility in Pocatello, Idaho. This Appendix describes the numerical model developed to evaluate the hydrologic performance of the proposed cap and to demonstrate its equivalency with the RCRA-guidance cap shown in Figure 1.

The hydrologic performance of the proposed cap and RCRA guidance cap was evaluated using the HELP computer program Version 3.07 (USAE, 1997) and the UNSAT-H computer program Version 2.03 (Fayer and Jones, 1990). The HELP model is recommended by EPA to evaluate the hydrologic performance of surface barrier designs. However, the HELP model has major limitations in its applicability to the proposed closure cap. To overcome these limitations, the HELP and UNSAT-H programs were used in conjunction to evaluate the performance of the proposed cap.

This Appendix is organized as follows. Section 2 presents a description of the proposed cap. Section 3 describes the approach and computer codes used to evaluate the performance of the cap, and the rationale behind this approach. Section 4 presents a detailed description of the input parameters and assumptions used in the different models. Section 5 discusses the modeling results. Section 6 concludes with a brief summary of this modeling effort and Section 7 presents a list of references.

2. DESCRIPTION OF THE PROPOSED CAP

The proposed closure cap for Pond 16S at the FMC facility in Pocatello, Idaho was designed to meet the following requirements:

1. Design the cap for a minimum functional life of 500 years.
2. Provide long-term minimization of migration of liquids through the cap.
3. Minimize the potential of biointrusion through the cap
4. Promote drainage and minimize erosion or abrasion of the cover.
5. Provide for drainage monitoring to check water balance at any time to evaluate the potential for leaks through the cap.

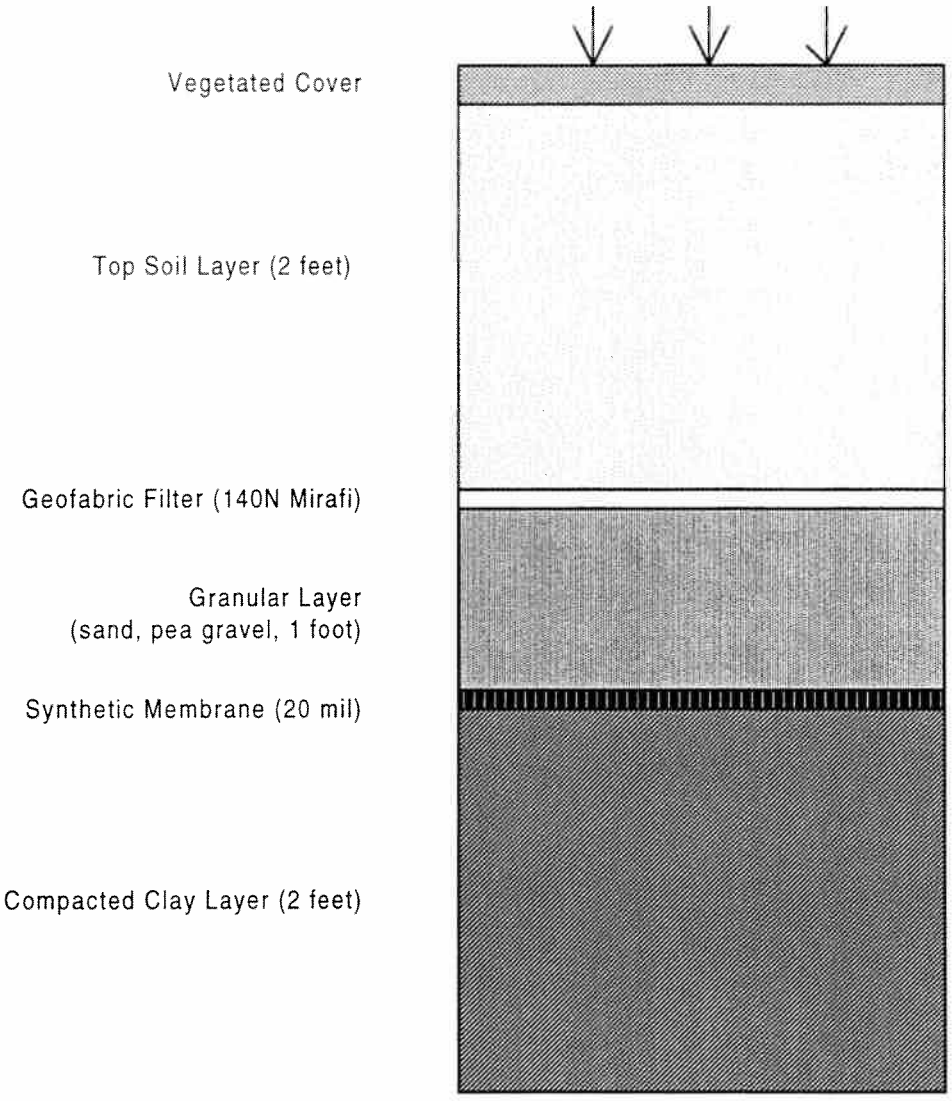

Figure H-1
RCRA Guidance Cap

To meet the above requirements, the proposed closure cap will consist of the following layers from top to bottom (Drawing 210-C-217):

- Topsoil consisting of 12 inches of native topsoil with 15% by weight pea gravel admixture, underlain by 30 inches of native topsoil without pea gravel. These two layers serve several important purposes including:

    a. provide a storage medium for the retention of infiltrating water and its subsequent removal by evapotranspiration, and

    b. allow for the natural growth of a vegetative cover which will enhance the removal of moisture from the soil and decrease wind and water erosion.

  The upper 12 inches include 15% by weight pea gravel which will serve to stabilize the cap surface and hence reduce erosion losses. The 15 % by weight proportion is based on wind tunnel tests conducted for the Hanford site in Washington State (Ligotke, 1993).

- Graded filter material consisting of 6 inches of coarse sand and 6 inches of 4" minus graded gravel or crushed and screened slag. This two-layer graded filter will prevent the overlying fine-textured soil from moving downward and accumulating in the coarse slag layer and/or the geofabric above the lateral drainage layer. This will assure the continued functionality of the capillary barrier.

- 18 inches of crushed and screened coarse slag. The purpose of this layer is to control biointrusion and to present an obstacle to inadvertent human intrusion. The general crushed slag product produced at the site will be comprised of angular slag, well-graded material, ranging in particle size from 1-1/2 inches to a maximum size of 12 inches.

- Sand filter material consisting of 12 inches of coarse sand to be placed underneath the coarse slag biointrusion layer to protect the underlying synthetic materials.

- Drainage layer consisting of geofabric and geosynthetic drainage net (Geonet). This layer and all underlying layers will form the secondary barrier of the Pond 16S cap.

- Flexible membrane liner (FML), HDPE having a minimum thickness of 60-mil.

- Low Hydraulic Conductivity Layer consisting of a Geosynthetic Clay Liner (GCL) having an equivalent hydraulic conductivity to that of a 2-ft thick clay layer. The material will consist of either a commercially available fabric/Bentonite or HDPE/Bentonite composite. The GCL is to be installed over a prepared subgrade which includes a 12 inch sand foundation layer over the slag fill.

In effect, the proposed cap consists of two main components:

1. A capillary barrier comprised of the topsoil, the graded filter material and the biointrusion layer. The purpose of the capillary barrier in semi-arid climates such as that present in

Pocatello is to limit the rate of infiltration through the cap and ensure the longevity of the cap.

2. A secondary barrier underlying the capillary barrier comprised of the drainage layer and the synthetic liners. The purpose of the secondary barrier is to act as a contingency barrier that will further decrease the net infiltration into the waste area by allowing for the lateral drainage of the excess infiltration through the capillary barrier.

3. METHODOLOGY

The performance of the proposed cap and RCRA guidance cap was evaluated using the HELP computer program Version 3.07 (USAE, 1997; see also Schroeder, et.al.,, 1994a, b) and the UNSAT-H computer program Version 2.03 (Fayer and Jones, 1990). The HELP model is recommended by EPA to evaluate the hydrologic performance of surface barrier designs. However, the application of the HELP model to the proposed closure cap has two major limitations. First, the HELP model assumes a time invariant evaporative zone depth which may not be a valid assumption for semi-arid climates similar to that at Pocatello. Second, the equations used in the HELP model to simulate flow in the unsaturated zone cannot accurately model flow through the capillary barrier proposed for Pond 16S. On the other hand, the computer code UNSAT-H is capable of simulating flow through a barrier layer, however does not account for any lateral drainage from the cap and cannot simulate flow though the FML. To overcome the limitations of each of these two programs, the hydrological performance of the proposed cap was evaluated in two steps. In the first step, flow through the capillary barrier (top soil to the sand foundation layer underneath the biointrusion layer) was simulated with the UNSAT-H computer program. In the second step of the analysis, the HELP program was used to simulate flow through the secondary cap underneath the barrier cap (foundation sand to the GCL). In this latter step, the daily percolation through to the bottom of the capillary cap resulting from the UNSAT-H analysis was incorporated into the HELP model input.

In addition to the approach presented above, the proposed cap was also modeled in its entirety using the HELP model for comparison purposes. Furthermore, to demonstrate the equivalency of the proposed cap to the RCRA guidance cap, the RCRA guidance cap was also evaluated using the HELP model. The input parameters and model results are described in Sections 4 and 5 of this Appendix. The computer programs HELP and UNSAT-H are briefly described in the following paragraphs.

The HELP program, Versions 1, 2 and 3, was developed by the U.S. Army Engineer Waterways Experiment Station (WES), Vicksburg, MS for the U.S. Protection Agency (EPA). HELP is a quasi two-dimensional hydrologic model which performs water balance analyses to predict water movement through landfills and other solid waste containment facilities. The program uses

empirical equations to estimate evapotranspiration, surface runoff, surface storage, snowmelt, lateral subsurface drainage, soil moisture storage, and infiltration from climatological, soil, and design specification data.

UNSAT-H Version 2.03 (Fayer and Jones, 1990) was developed at the Pacific Northwest Laboratory for assessing the water dynamics of arid, near-surface waste disposal sites. The model simulates the flow of water and heat through unsaturated multi-layer porous media. Flow of liquid water and water vapor are calculated based on the one-dimensional Richards' equation and Fick's law of diffusive vapor, respectively. UNSAT-H uses time-dependent boundary conditions at the ground surface, calculated from daily meteorological data. UNSAT-H has been used to evaluate the performance of capillary barrier systems at Hanford (Fayer et al., 1992; Olson, 1996, DOE, 1996).

4. INPUT DATA

4.1 Weather Data

Climatological data for the UNSAT-H and the HELP programs consist of daily rainfall, temperature, and solar radiation data. Because the length of the climatological data records is much shorter than the 500-year functional life of the proposed cap, daily rainfall, temperature and radiation data were synthetically generated. The routine used to generate the climatological data was developed by the USDA Agricultural Research Service (Richardson and Wright, 1984) and is described in the HELP manual (Schroeder, et.al., 1994a). The generating procedure is designed to preserve the dependence in time, the correlation between variables and the seasonal characteristics of the actual weather data at the specified locations.

The 500-year synthetic data were generated by estimating first the statistical rainfall distribution data at the site from rainfall data recorded at the Pocatello Municipal Airport (National Weather Service Station No. 24156) for the period 1948 to 1991. Table 1 gives the estimated parameters *a* and *b* defining the gamma function that describes the probability distribution of daily rainfall used in the synthetic data generator in HELP. These values are estimated for each month of the year. Based on these values the daily rainfall, daily minimum and maximum temperature and daily solar radiation were generated for the 500-year period using the routines developed the USDA Agricultural Research Service (Richardson and Wright, 1984).

4.2 Properties of Materials Used in Proposed Cap

As noted in Section 2, the proposed cap was evaluated using a two-step approach combining the UNSAT-H and HELP computer programs. The first step simulates flow through the capillary barrier using the UNSAT-H program. In the second step, the net infiltration from the capillary

TABLE 1
MEAN PRECIPITATION AND *a* AND *b* VALUES
OF THE G-FUNCTION DISTRIBUTION OF DAILY RAINFALL IN POCATELLO

Month	Pocatello Municipal Airport NWS Station No. 24156 (1948-1991)		
	Precipitation	*a*	*b*
Jan.	1.08	0.711	0.125
Feb.	0.87	0.771	0.109
Mar.	1.17	0.789	0.144
Apr.	1.15	0.842	0.166
May	1.31	0.646	0.216
Jun.	1.01	0.668	0.222
Jul.	0.50	0.530	0.242
Aug.	0.61	0.555	0.243
Sep.	0.72	0.703	0.215
Oct.	0.85	0.575	0.282
Nov.	1.09	0.905	0.131
Dec.	1.09	0.786	0.127

barrier is then used as part of the input into the HELP model comprising of the secondary barrier underneath the biointrusion layer. For comparison purposes, a HELP model was developed for the entire proposed cap as well as for the EPA RCRA guidance cap.

This section presents the input parameters and assumptions used in all 3 models described above. The input parameters used in the UNSAT-H/HELP model and the HELP model for the proposed cap are listed in Table 2. In general, these parameters were based on field data when available, or on literature value for comparable materials. Of the parameters listed in Table 2, the thickness, porosity and saturated hydraulic conductivity parameters are common to both models, UNSAT-H and HELP. The Van Genuchten parameters n, α and residual moisture content, θ_r, are needed for the UNSAT-H model, while the field capacity and the wilting point are required in the HELP

model only. In general, these latter two parameters were set equal to default HELP values found in the HELP documentation (Table 4, Schroeder, et.al., 1994b) for comparable materials.

Key input parameters for the analysis of the capillary barrier cap design are the hydraulic conductivity and the moisture characteristic curves of the soils used in the cap. The moisture characteristic curves provide the relative hydraulic conductivity and the matrix potential, or suction head, as a function of the degree of saturation. Different functions are used in the literature to represent these curves. In the present analysis, the moisture characteristic curves were defined using the water retention functions proposed by van Genuchten (1978), which require assumptions of the three constants, n, α, and θ_r. The values of these constants were determined from published values in the literature for comparable soils (Carsel and Parrish, 1988).

A brief discussion of the parameter values listed in Table 2 is presented below:

Layer 1-- Top Soil: The thickness of top soil layer used in the UNSAT-H and HELP models was conservatively set to 36 inches which is the 42 inches of top soil that will be placed over Pond 16S less the estimated 500-year water and wind erosion losses of 6 inches. The saturated hydraulic conductivity was set to 9.35 x 10^{-4} cm/s which is approximately two times the HELP default value for fine sandy loam (page 30, Table 4, Schroeder, et.al., 1994b). Default HELP values were also used for the porosity, field capacity, and wilting point. The Van Genuchten parameters used to define the characteristic curves of this soil material were based on published literature values for comparable soils (Carsel and Parrish, 1988). Laboratory testing conducted on the locally available soils that will be used for this layer indicate that the above parameter values are conservative.

Layer 2-- Sand Filter (Transition) Layer: Layer 2 is a transition layer consisting of 6 inches of coarse sand. The saturated hydraulic conductivity, porosity, field capacity and wilting point values used in the numerical model were set to the default HELP values for coarse sand. The Van Genuchten parameters used for this layer were set equal to the suggested values for sand (Carsel and Parrish, 1988).

Layer 3-- Gravel Filter (Crushed Slag Transition) Layer: Layer 3 is a transition layer consisting of 6 inches of 4" minus gravel or graded crushed and screened slag. In the numerical model, Layer 3 was assumed to have soil properties similar to that of gravel. Therefore, the layer's saturated hydraulic conductivity was set to 0.1 cm/s. The van Genuchten parameters were based on the values used for the engineered barrier study at the 200 Areas at Hanford, Washington (Appendix C, DOE, 1996). Default HELP values were used for the porosity, field capacity, and wilting point.

TABLE 2
PROPERTIES OF THE MATERIALS
USED FOR THE PROPOSED CAP IN THE UNSAT-H AND HELP MODELS

Layer	Thickness (in)	Saturated Conductivity (cm/s)	Porosity	Residual Moisture Content[1]	n[1]	a[1]	Field Capacity[2]	Wilting Point[2]
Top soil	36	9.35×10^{-4}	0.473	0.067	1.41	0.015	0.222	.105
Sand Transition Layer	6	0.01	.417	0.04	2.68	0.15	0.045	0.018
Crushed Slag Transition Layer	6	0.1	.397	0.03	2.68	1.0	0.032	0.013
Coarse Slag	18	1.0	.375	0.006	3.0	10.0	0.022	0.01
Foundation Layer	12	0.01	.417	0.04	2.68	0.15	0.045	0.018
Geonet	0.2	10	.85	-	-	-	.01	.005
FML	0.04	2×10^{-12}	-	-	-	-	-	-
GCL	.17	3×10^{-9}	.75	-	-	-	.747	.4

[1] Parameters required for the UNSAT-H model only

[2] Parameters required for the HELP model only

Layer 4-- Coarse Slag: Layer 4 consists of 18 inches of crushed and screened coarse slag, ranging in particle size from 1-1/2 inches to a maximum size of 12 inches. The hydraulic conductivity of this layer was assumed to be 1 cm/s, one order of magnitude greater than that of Layer 3. The van Genuchten parameters was set equal to the values used for the biointrusion layer of the engineered surface barrier at the 200 Areas at Hanford, Washington (Appendix C, DOE, 1996).

Layer 5-- Sand Filter Layer: Layer 5 consists of 12 inches of coarse sand. Its hydraulic conductivity was assumed to be identical to that of Layer 2.

Layer 6-- Geonet Drainage Layer: From the technical specifications and typical commercially available materials, the thickness and transmissivity of the geonet at 15,000 psf compressive are 0.2 inches and 0.001 m^2/s, respectively. These values correspond to a saturated hydraulic conductivity of 20 cm/s. To provide some measure of conservatism, the geonet hydraulic conductivity in the HELP model was set to 10 cm/s.

Layer 7-- Flexible Membrane Liner (FML): The thickness of the FML used in the model is 40 mil which is less than the minimum of 60 mil proposed for the cap. The hydraulic conductivity of the FML was set equal to 2×10^{-12} cm/s, which is a typical value for a commercially available HDPE liner material. This value is also an order of magnitude larger than the HELP default value for HDPE. The placement quality of the FML was assumed to be good. Because the design life of the cap is quite long, the pinhole density was assumed to be "poor" on a scale ranging from "excellent" to "poor", which corresponds to 10 holes/acre.

Layer 8-- Geosynthetic Clay Liner (GCL): The hydraulic conductivity of the GCL was set equal to 5×10^{-9} cm/s, the typical value for a commercially available fabric/Bentonite GCL. This value which is more conservative than both the value specified for Type I GCLs (4×10^{-11} cm/s) and the HELP default value for a bentonite mat (3×10^{-9} cm/s). Sensitivity analysis previously conducted indicated that the net infiltration rate is not sensitive to the GCLs hydraulic conductivity.

For comparison purposes, the infiltration through EPA's RCRA guidance cap was simulated using the HELP model. A list of the material properties used for the RCRA guidance cap are presented in Table 3.

4.3 Transpiration

A key component in the cap's water budget is transpiration which is the removal of water from the soil by transpiring plants. In the UNSAT-H model, the transpiration term is calculated in three steps. First, the potential evapotranspiration is partitioned into potential evaporation and potential transpiration. The transpiration potential is then distributed over the root zone in

TABLE 3
PROPERTIES OF THE MATERIALS
USED FOR THE RCRA GUIDANCE CAP

Layer	Thickness (in)	Saturated Conductivity (cm/s)	Porosity	Field Capacity	Wilting Point
Top soil	24	9.35×10^{-4}	0.473	0.222	0.105
Sand Transition Layer	12	0.01	.417	0.045	0.018
FML	0.04	2×10^{-12}	-	-	-
Clay Liner	24	1×10^{-7}	0.43	.367	0.28

proportion to the relative root density at each depth. As described in the closure cap, the vegetative cover will consist of a mixture of native grasses. To provide vegetation compatible with the local climatic conditions, the mixture was developed through consultation with the Agricultural Research Center, College of Forestry, University of Idaho, Moscow, ID, and the Cooperative Extension System, University of Idaho at Pocatello. The maximum depth and plant biomass used in the model are 3.5 ft and 440 g/m^2, respectively. Fifty percent (50 %) of the cap's surface is assumed to be bare of plants. All these values are consistent with the proposed vegetation mixture. Finally, the actual transpiration as a function of depth and time is computed from the potential evapotranspiration and the soil's moisture content.

In the HELP model, the top soil was conservatively assumed to maintain a vegetative cover with a leaf area index, LAI =1, which corresponds to a "poor stand of grass. The evapotranspiration zone depth was assumed to be 24 inches which is consistent with the default HELP for the area of Pocatello.

4.4 Additional Assumptions

In addition to the input parameters and assumptions discussed in the Sections 4.1 through 4.3, the UNSAT-H model includes the following assumptions:

- No surface runoff is generated. This is a very conservative assumption because net infiltration will primarily be a result of extreme rainfall events. However, a significant portion of the precipitation falling during these events may develop into surface runoff.

- The capillary barrier is assumed to generate no lateral drainage. This means that any water that does not evaporate or is not taken by the plants will infiltrate through the cap.
- To minimize the impact of the assumed initial moisture distribution in the simulated soil column all simulations were run for 600 years, out of which the last 500 years were used to estimate the average percolation through the cap. The effect of the assumed initial conditions is negligible after the first 100 years of simulation.

The following additional assumptions were incorporated in the HELP models for both the proposed and guidance caps:

- To maximize percolation rates, no surface runoff was allowed.
- Initial conditions were set to steady state conditions, as estimated by the HELP program.
- The drainage length of the cap was conservatively set to 400 ft.

5. MODEL RESULTS

The hydrologic performance of the proposed closure cap was evaluated based on the input data and assumptions described in the previous section. Figure 2 shows the estimated annual percolation rate at the bottom of the biointrusion layer and the bottom of the GCL for the simulated 600 years of precipitation data generated using the UNSAT-H/HELP approach described in Section 2. The long-term percolation through the bottom of the biointrusion layer is 0.05 in/yr. This rate was calculated using the UNSAT-H model for the capillary barrier. The long term average percolation through the bottom of the GCL, estimated with the HELP model for the secondary cap underneath the biointrusion barrier and based on the last 500 years of this simulation, is 8×10^{-6} in/yr. Figure 2 also shows that the maximum annual percolation through the bottom of the GCL is consistently less than 10^{-4} in/yr.

The performance of the proposed cap as well as the EPA RCRA guidance cap were also evaluated with the HELP model. A summary of all the of the different modeling simulations is presented in Table 4. These results show that for both of the modeling approaches, the net annual percolation through the proposed cap is lower than that predicted for the RCRA guidance cap. This indicates that the performance of the proposed cap exceeds that of the RCRA guidance cap.

Figure 2: Estimated Annual Percolation Through the Proposed Cap

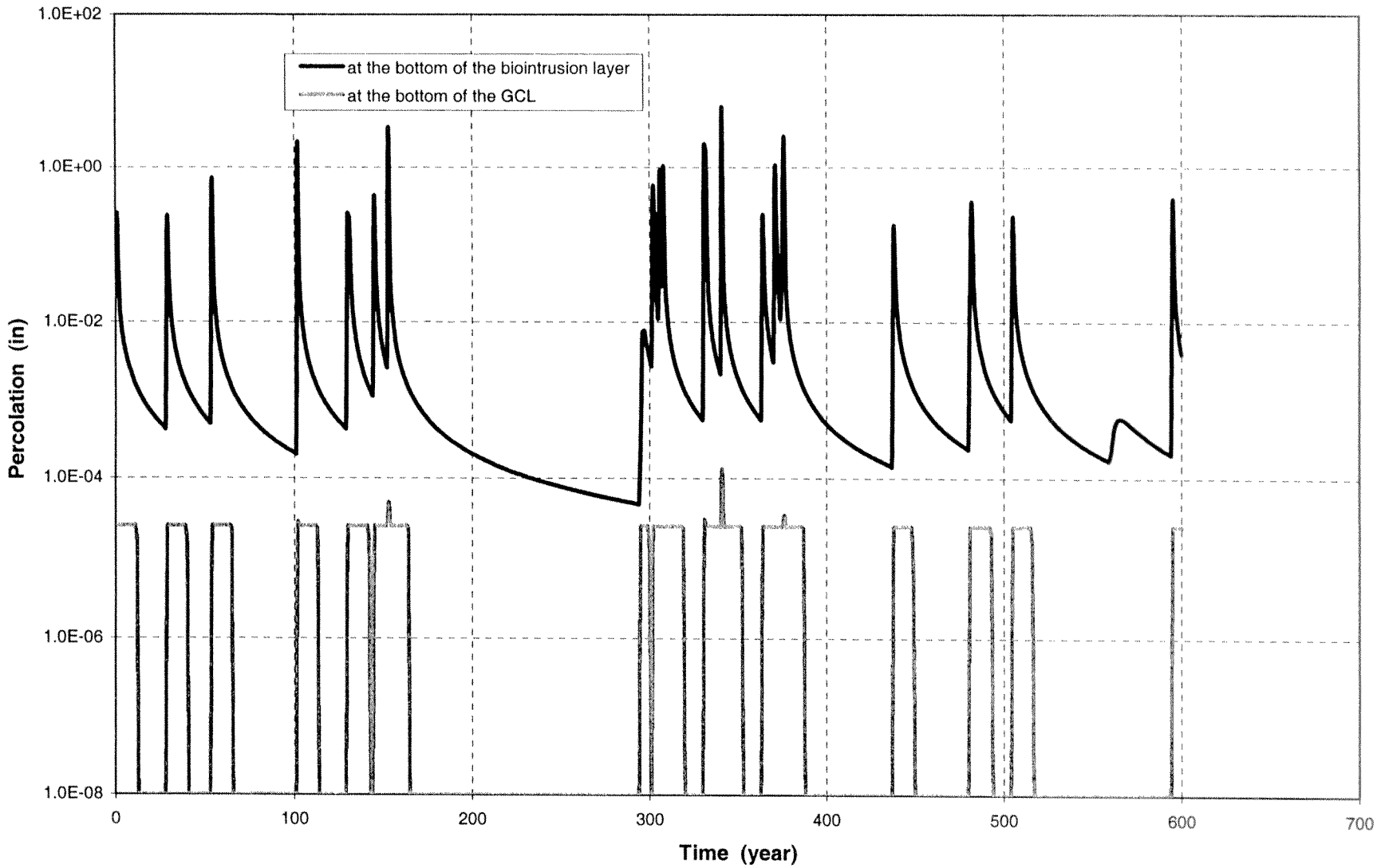

TABLE 4
MODELING RESULTS
FOR THE PROPOSED AND GUIDANCE CAPS

Cap	Modeling Approach	Runoff (in/yr)	Evapotranspiration (in/yr)	Lateral Drainage (in/yr)	Percolation (in/yr)
Proposed Cap[1]	UNSAT-H/HELP	-	11.62	0.05	8×10^{-6}
	HELP	-	11.41	0.25	2×10^{-5}
RCRA Guidance Cap[2]	HELP	-	11.10	0.32	18×10^{-5}

[1] Simulated for 500 years

[2] Simulated for 44 years

6. SUMMARY

A numerical model was developed to evaluate the hydrological performance of the proposed cap and demonstrate its equivalency with the EPA's RCRA guidance cap. Two approaches were used to calculate the long-term water budget through the different layers of the proposed cap. The first approach is based on the combined application of two computer programs, UNSAT-H and HELP. The UNSAT-H program is used to simulate the movement of moisture through the capillary barrier, while the HELP program is used to simulate moisture movement through the secondary barrier underneath the capillary barrier. By combining these two computer programs, some of the limitations of each program are overcome. For comparison purposes, the proposed cap was also simulated in its entirety using the HELP program. To demonstrate the equivalency of the proposed cap to the guidance cap, the guidance cap was also modeled using the HELP program.

Based on available field data and data published in the literature for comparable materials, the water balance through the proposed and guidance caps was simulated for 500 years. The results of this modeling effort indicate that the net infiltration through the proposed cap is negligible (on the order of 10^{-5} to 10^{-6} in/yr). Furthermore, the performance of the proposed cap is expected to exceed the performance of the RCRA guidance cap.

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ATTACHMENT H-1

HELP SIMULATIONS COMPUTER FILES

This attachment includes copies of the input and output files used in the UNSAT-H and HELP models described in Appendix H. All of the input/output files listed below are included on the compact disk (CD) included at the end of this attachment.

HELP Model for Proposed Cap (8 Layers)

Because each HELP model (Version 3.07) is limited to 100 years, the long term performance of the cap was simulated by running five consecutive 100-years simulations. The moisture content at the end of each simulation was used as initial conditions in the following simulation. The input/output files are:

- Soil Properties and Initial Conditions (6 files, one for each 100 years of simulation)
  SOIL1.D10, SOIL2.D10, ... SOIL6.D10
- Precipitation (6 files, one for each 100 years of simulation)
  RAIN1.D4, RAIN2.D4, ... RAIN6.D4
- Temperature (6 files, one for each 100 years of simulation)
  TEMP1.D7, TEMP2.D7, ... TEMP6.D7
- Solar Radiation (6 files, one for each 100 years of simulation)
  RAD1.D13, RAD2.D13, ... RAD6.D13
- Evapotranspiration (1 file for 600 years of simulation)
  POCATEL.D11
- Output (6 files, one for each 100 years of simulation)
  OUT8L1.OUT, OUT8L2.OUT, ... OUT8L6.OUT

HELP Model for EPA RCRA Guidance Cap

The RCRA Guidance cap was evaluated using the HELP model based on 44 years of recorded data between 1948 and 1991. The input/output files are:

- Soil Properties:
  RCRA.D10
- Precipitation (1 file for 44 years)
  POCATEL.D4
- Temperature (1 file for 44 years)
  POCATEL.D7
- Solar Radiation (1 file for 44 years)
  POCATEL.D13
- Evapotranspiration (1 file for 44 years)
  POCATEL.D11

- Output (1 file for 44 years)

  RCRA.OUT

UNSAT-H/HELP Model for the Proposed Cap

The proposed cap was also evaluated using a combined UNSAT-H/HELP model. The UNSAT-H was used to model moisture movement through the capillary barrier; the HELP model was used to model moisture through the secondary barrier underneath the biointrusion layer. The input/output files for the UNSAT-H model are

- Parameter input files (total of 600 files, one file for each year of simulation):

  Y001.INP, Y002.INP, ..., Y600.INP

- Input weather data files (total of 600 files, one file for each year of simulation):

  Y001.WEA, Y002.WEA, ..., Y600.WEA

  Files include daily precipitation, maximum and minimum temperatures, solar radiation, cloud cover, wind speed, etc.

- Output (total 600 files, one file for each year of simulation):

  Y001.INF, Y002.INF, ..., Y600.INF

  Files include computed daily fluxes at different depths for 600 years of simulation

The input/output files for the HELP model (4 layers) are:

- Soil Properties and Initial Conditions (6 files, one for each 100 years of simulation)

  SOIL1S.D10, SOIL2S.D10, ... SOIL6S.D10

- Precipitation (6 files, one for each 100 years of simulation- from UNSAT-H model)

  INF1.D4, INF2.D4, ... INF6.D4

- Temperature (average temperature from 44 years of record)

  TEMP.D7

- Solar Radiation (modified to reflect conditions below the biointrusion layer)

  RAD.D13

- Evapotranspiration (modified to reflect conditions below the biointrusion layer))

  EVAP.D11

- Output (6 files, one for each 100 years of simulation)

  OUT4L1.OUT, OUT4L2.OUT, ... OUT4L6.OUT

- Summary (yearly output from the UNSAT-H and HELP models)

  SUMMARY.XLS